

# **CEQA DRAINAGE STUDY**

**1505 York Drive  
County of San Diego  
Tentative Map No.5443  
ER 87-08-036A**

Prepared for:

Gary Van Elk  
841 Quails Trail  
Vista, CA 92081

Prepared by:

**bHA, Inc.**  
land planning, civil engineering, surveying  
5115 Avenida Encinas, Suite L  
Carlsbad, CA 92008-4387  
(760) 931-8700

March 25, 2008

W.O. 757-1019-400

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I.	Discussion:	Purpose and Scope Project Description Study Method Project Design Conclusions
II.	Calculations	Existing Hydrology Developed Hydrology <u>Curb Inlet Sizing</u> Existing 100 Year Flood Inundation (HEC-RAS) Developed 100 Year Flood Inundation (HEC-RAS)
III.	Exhibits	Exhibit A: Existing Hydrology Map Exhibit B: Developed Hydrology Map Exhibit C: 100 Year Inundation Cross Section (HEC-RAS)
IV.	References	

## **I. DISCUSSION**

## **PURPOSE AND SCOPE:**

The purpose of this report is to publish the results of hydrology and hydraulic computer analysis for the proposed Tentative Map for 1505 York Drive Subdivision (County of San Diego - Tentative Map No. 5443). The proposed project is a 3.00-acre residential subdivision with 5 lots. The scope is to study the existing and developed hydrology and hydraulics as it influences existing storm drain facilities in the vicinity during a 100-year frequency storm event. For purpose of this report, the project will be referred as "York Drive".

## **PROJECT DESCRIPTION:**

York Drive is located on the western side of York Drive, near York View Circle and approximately 3000 feet south of Monte Vista Drive. Currently, two single family residences occupy the site. The project is surrounded by single family residences. Upstream runoff is intercepted by an existing 18-inch storm drain crossing York Drive along the easterly boundary and by a shallow intermittent natural swale near the northwesterly property corner. The 18-inch storm drain discharges the runoff on-site, where it drains westerly to the shallow intermittent natural drainage swale to the westerly boundary, where it confluences with the runoff from the north.

This project proposes to subdivide the existing property into 5 lots. One of the existing homes will be demolished and removed. While the other existing home, the one nearest to York Drive, will remain. This proposed development consist of pads for single family residences, a private street, and infrastructures.

The developed hydrology this project respects the existing drainage basin. The existing runoff intercepted by the existing 18-inch storm drain at York Drive will be conveyed to a proposed catch basin at the end of the on-site cul-de-sac via a 30-inch proposed storm drain system. The flow is then conveyed by two 24-inch storm drains in the cul-de-sac and along the northerly lot line of Lot 4. To maintain the minimum cover of 2 feet over the storm drain crossing Lot 4 and to daylight the storm drain into the shallow intermittent natural drainage swale, two 24-inch storm drains are used instead of a 30-inch pipe.

The 10-foot long sump curb inlet in the cul-de-sac at Node 18 is oversized. However, in the event the inlet becomes clogged, runoff will flow down the driveway of Lot 4 and into a grassy swale as detailed on the Tentative Map.

An existing and developed 100-year flood inundation analysis has been done for the ditch/swale at the project outlet using the "Hydrologic Engineering Centers River Analysis System" (HEC-RAS). The development of this project will not significantly affect the existing 100 year flood inundation line and channel velocities. Disturbances to the shallow intermittent natural drainage swale has been minimized. The water surface elevations will remain the same, and the change in velocities are negligible. See Table 1.2 for comparison of existing and developed 100-Year flood inundation cross sections (HEC-RAS).

## **STUDY METHOD:**

The method of analysis was based on the Modified Rational Method according to the County of San Diego Hydrology Manual, 2003 edition. The Hydrology and Hydraulic Analysis were

done on HydroSoft by Advanced Engineering Software.

Drainage basin areas were determined from the proposed grades shown on the Tentative Map for York Drive and 200 scale topographic map from County of San Diego.

The Rational Method provided the following variable coefficients:

P6 = 3.5  
Soil Group = "B"

The runoff coefficient for:

Existing Condition = Low Density Residence (1 du/ac or less) = 0.32  
Developed Condition = Low Density Residence (2 du/ac or less) = 0.38

See Table 1.1 below comparison of existing and developed storm drain flows.

**Table 1.1 - Comparison of Existing and Developed Storm Drain Flows**

Node	Existing (cfs/ac)	Developed (cfs/ac)
13/27	277.6/178.7	<u>278.9/178.3</u>
Average	1.55cfs/ac	<u>1.56cfs/ac</u>

**Table 1.2 - Comparison of Existing and Developed 100-Year Flood Inundation Cross Sections (HEC-RAS)**

Cross Section No.	Existing Water Surface Elevation (wsel)	Developed Water Surface Elevation (wsel)	Existing Velocity (ft/s)	Developed Velocity (ft/s)
12	<u>460.92</u>	<u>460.92</u>	<u>4.39</u>	<u>4.39</u>
11	<u>460.55</u>	<u>460.55</u>	<u>4.65</u>	<u>4.65</u>
10	<u>459.63</u>	<u>459.63</u>	<u>3.43</u>	<u>3.43</u>
9	<u>459.36</u>	<u>459.36</u>	<u>4.69</u>	<u>4.69</u>
8	<u>458.97</u>	<u>458.94</u>	<u>3.25</u>	<u>3.63 (+38)</u>
7	<u>458.61</u>	<u>458.61</u>	<u>4.11</u>	<u>4.03</u>

<u>6</u>	<u>458.29</u>	<u>458.29</u>	<u>3.96</u>	<u>4.02</u>
<u>5</u>	<u>457.97</u>	<u>457.97</u>	<u>3.66</u>	<u>3.66</u>
<u>4</u>	<u>457.41</u>	<u>457.41</u>	<u>3.85</u>	<u>3.85</u>
<u>3</u>	<u>456.82</u>	<u>456.82</u>	<u>3.30</u>	<u>3.30</u>
<u>2</u>	<u>456.39</u>	<u>456.39</u>	<u>4.19</u>	<u>4.19</u>
<u>1</u>	<u>455.59</u>	<u>455.59</u>	<u>4.30</u>	<u>4.30</u>

#### CONCLUSION:

The development of York Drive will increase the runoff from 1.55 cfs per acre for existing condition to ~~1.57~~ 1.56 cfs per acre for the developed condition. This increase in runoff will not significantly affect the surrounding properties or the 100-year flood inundation limits.

## DECLARATION OF RESPONSIBLE CHARGE

I hereby declare that I am the Engineer of Work for this project, that I have exercised responsible charge over the design of the project as defined in section 6703 of the business and professions code, and that the design is consistent with current standards.

I understand that the check of project drawings and specifications by the County of San Diego is confined to a review only and does not relieve me, as Engineer of Work, of my responsibilities for project design.

---

Ronald L. Holloway R.C.E. 29271 Date

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6	458.29	458.29	3.96	4.02
5	457.97	457.97	3.66	3.66

4	457.41	457.41	3.85	3.85
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---

Bruce L. Rice    RCE 60676    Date

## II. CALCULATIONS

## **II. CALCULATIONS**

### **A. EXISTING HYDROLOGY**

\*\*\*\*\*

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE  
Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT  
2003, 1985, 1981 HYDROLOGY MANUAL

(c) Copyright 1982-2007 Advanced Engineering Software (aes)  
Ver. 3.0 Release Date: 06/01/2007 License ID 1459

Analysis prepared by:

BHA INC.  
5115 AVENDIA ENCINAS, SUITE L  
CARLSBAD, CA 92008

\*\*\*\*\* DESCRIPTION OF STUDY \*\*\*\*\*

\* 1505 YORK DRIVE - W.O. 757-1019-400  
\* EXISTING 100 YEAR HYDROLOGY  
\* EXISTING BASIN 1

FILE NAME: K:\HYDRO\1019\DEV1.DAT  
TIME/DATE OF STUDY: 10:18 10/15/2007

-----  
USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:  
-----

2003 SAN DIEGO MANUAL CRITERIA

USER SPECIFIED STORM EVENT(YEAR) = 100.00

6-HOUR DURATION PRECIPITATION (INCHES) = 3.500

SPECIFIED MINIMUM PIPE SIZE(INCH) = 8.00

SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90

SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD

NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS

\*USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL\*

NO.	HALF-CROWN TO WIDTH	CROWN TO CROSSFALL	STREET-CROSSFALL: IN- / OUT-/PARK- SIDE / SIDE/ WAY	CURB HEIGHT	GUTTER-GEOMETRIES: WIDTH	LIP	HIKE	FACTOR
1	30.0	20.0	0.018/0.018/0.020	0.67	2.00	0.0313	0.167	0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

1. Relative Flow-Depth = 0.00 FEET

as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)

2. (Depth)\*(Velocity) Constraint = 6.0 (FT\*FT/S)

\*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN  
OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.\*

+-----+  
| 1505 YORK DRIVE - W.O. 757-1019-400 |  
| DEVELOPED 100 YEAR HYDROLOGY |  
| DEVELOPED BASIN 1 |  
+-----+

\*\*\*\*\*  
FLOW PROCESS FROM NODE 20.00 TO NODE 21.00 IS CODE = 21  
-----

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<

RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .3200  
SOIL CLASSIFICATION IS "B"  
S.C.S. CURVE NUMBER (AMC II) = 65  
INITIAL SUBAREA FLOW-LENGTH(FEET) = 80.00  
UPSTREAM ELEVATION(FEET) = 644.50  
DOWNSTREAM ELEVATION(FEET) = 640.00  
ELEVATION DIFFERENCE(FEET) = 4.50  
SUBAREA OVERLAND TIME OF FLOW(MIN.) = 7.061  
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 7.381  
SUBAREA RUNOFF(CFS) = 0.38  
TOTAL AREA(ACRES) = 0.16 TOTAL RUNOFF(CFS) = 0.38

\*\*\*\*\*  
FLOW PROCESS FROM NODE 21.00 TO NODE 4.00 IS CODE = 51  
-----

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<  
>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<

ELEVATION DATA: UPSTREAM(FEET) = 640.00 DOWNSTREAM(FEET) = 457.50  
CHANNEL LENGTH THRU SUBAREA(FEET) = 2700.00 CHANNEL SLOPE = 0.0676  
CHANNEL BASE(FEET) = 20.00 "Z" FACTOR = 20.000  
MANNING'S FACTOR = 0.035 MAXIMUM DEPTH(FEET) = 1.00  
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.702  
RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .3200  
SOIL CLASSIFICATION IS "B"  
S.C.S. CURVE NUMBER (AMC II) = 65  
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 118.76  
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 6.30  
AVERAGE FLOW DEPTH(FEET) = 0.59 TRAVEL TIME(MIN.) = 7.15  
Tc(MIN.) = 14.21  
SUBAREA AREA(ACRES) = 151.50 SUBAREA RUNOFF(CFS) = 227.94  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.320  
TOTAL AREA(ACRES) = 151.7 PEAK FLOW RATE(CFS) = 228.18

END OF SUBAREA CHANNEL FLOW HYDRAULICS:

DEPTH(FEET) = 0.83 FLOW VELOCITY(FEET/SEC.) = 7.55  
LONGEST FLOWPATH FROM NODE 20.00 TO NODE 4.00 = 2780.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 4.00 TO NODE 4.00 IS CODE = 10  
-----

>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<

\*\*\*\*\*  
FLOW PROCESS FROM NODE 1.00 TO NODE 2.00 IS CODE = 21  
-----

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<

```
=====
RESIDENTIAL (2. DU/AC OR LESS) RUNOFF COEFFICIENT = .3800
SOIL CLASSIFICATION IS "B"
S.C.S. CURVE NUMBER (AMC II) = 68
INITIAL SUBAREA FLOW-LENGTH(FEET) = 70.00
UPSTREAM ELEVATION(FEET) = 636.20
DOWNSTREAM ELEVATION(FEET) = 625.00
ELEVATION DIFFERENCE(FEET) = 11.20
SUBAREA OVERLAND TIME OF FLOW(MIN.) = 5.033
WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 9.182
SUBAREA RUNOFF(CFS) = 0.35
TOTAL AREA(ACRES) = 0.10 TOTAL RUNOFF(CFS) = 0.35
```

```
*****
FLOW PROCESS FROM NODE 2.00 TO NODE 3.00 IS CODE = 51
```

```
>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<
>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<
```

```
=====
ELEVATION DATA: UPSTREAM(FEET) = 625.00 DOWNSTREAM(FEET) = 496.00
CHANNEL LENGTH THRU SUBAREA(FEET) = 640.00 CHANNEL SLOPE = 0.2016
CHANNEL BASE(FEET) = 5.00 "Z" FACTOR = 5.000
MANNING'S FACTOR = 0.030 MAXIMUM DEPTH(FEET) = 1.00
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 7.172
RESIDENTIAL (2. DU/AC OR LESS) RUNOFF COEFFICIENT = .3800
SOIL CLASSIFICATION IS "B"
S.C.S. CURVE NUMBER (AMC II) = 68
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 2.55
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 4.54
AVERAGE FLOW DEPTH(FEET) = 0.10 TRAVEL TIME(MIN.) = 2.35
Tc(MIN.) = 7.38
SUBAREA AREA(ACRES) = 1.60 SUBAREA RUNOFF(CFS) = 4.36
AREA-AVERAGE RUNOFF COEFFICIENT = 0.380
TOTAL AREA(ACRES) = 1.7 PEAK FLOW RATE(CFS) = 4.63
```

END OF SUBAREA CHANNEL FLOW HYDRAULICS:

DEPTH(FEET) = 0.14 FLOW VELOCITY(FEET/SEC.) = 5.71  
LONGEST FLOWPATH FROM NODE 1.00 TO NODE 3.00 = 710.00 FEET.

```
+-----+
| BEGIN BROW DITCH CALCULATION
| BROW DITCH IS CALCULATED AS IF IT IS A
| 36-INCH PIPE FLOWING NO MORE THAN HALF FULL
+-----+
```

```
*****
FLOW PROCESS FROM NODE 3.00 TO NODE 4.00 IS CODE = 41
```

```
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<
```

```
=====
ELEVATION DATA: UPSTREAM(FEET) = 496.00 DOWNSTREAM(FEET) = 457.50
FLOW LENGTH(FEET) = 555.00 MANNING'S N = 0.030
```

DEPTH OF FLOW IN 18.0 INCH PIPE IS 8.0 INCHES  
 PIPE-FLOW VELOCITY(FEET/SEC.) = 6.11  
 GIVEN PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1  
 PIPE-FLOW(CFS) = 4.63  
 PIPE TRAVEL TIME(MIN.) = 1.51 Tc(MIN.) = 8.90  
 LONGEST FLOWPATH FROM NODE 1.00 TO NODE 4.00 = 1265.00 FEET.

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 3.00 TO NODE 4.00 IS CODE = 81

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 6.359  
 RESIDENTIAL (2. DU/AC OR LESS) RUNOFF COEFFICIENT = .3800  
 SOIL CLASSIFICATION IS "B"  
 S.C.S. CURVE NUMBER (AMC II) = 68  
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.3800  
 SUBAREA AREA(ACRES) = 2.40 SUBAREA RUNOFF(CFS) = 5.80  
 TOTAL AREA(ACRES) = 4.1 TOTAL RUNOFF(CFS) = 9.91  
 TC(MIN.) = 8.90

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 4.00 TO NODE 4.00 IS CODE = 11

>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<

\*\* MAIN STREAM CONFLUENCE DATA \*\*  
 STREAM RUNOFF Tc INTENSITY AREA  
 NUMBER (CFS) (MIN.) (INCH/HOUR) (ACRE)  
 1 9.91 8.90 6.359 4.10  
 LONGEST FLOWPATH FROM NODE 1.00 TO NODE 4.00 = 1265.00 FEET.

\*\* MEMORY BANK # 2 CONFLUENCE DATA \*\*  
 STREAM RUNOFF Tc INTENSITY AREA  
 NUMBER (CFS) (MIN.) (INCH/HOUR) (ACRE)  
 1 228.18 14.21 4.702 151.66  
 LONGEST FLOWPATH FROM NODE 20.00 TO NODE 4.00 = 2780.00 FEET.

\*\* PEAK FLOW RATE TABLE \*\*  
 STREAM RUNOFF Tc INTENSITY  
 NUMBER (CFS) (MIN.) (INCH/HOUR)  
 1 152.81 8.90 6.359  
 2 235.51 14.21 4.702

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 235.51 Tc(MIN.) = 14.21  
 TOTAL AREA(ACRES) = 155.8

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 4.00 TO NODE 4.00 IS CODE = 12

>>>>CLEAR MEMORY BANK # 2 <<<<

```
*****
FLOW PROCESS FROM NODE      4.00 TO NODE      16.00 IS CODE =  51
-----
>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<
>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) =    457.50 DOWNSTREAM(FEET) =    457.30
CHANNEL LENGTH THRU SUBAREA(FEET) =    95.00 CHANNEL SLOPE =  0.0021
CHANNEL BASE(FEET) =    10.00 "Z" FACTOR =    5.000
MANNING'S FACTOR = 0.030 MAXIMUM DEPTH(FEET) =    1.00

==>>WARNING: FLOW IN CHANNEL EXCEEDS CHANNEL
CAPACITY( NORMAL DEPTH EQUAL TO SPECIFIED MAXIMUM
ALLOWABLE DEPTH).
AS AN APPROXIMATION, FLOWDEPTH IS SET AT MAXIMUM
ALLOWABLE DEPTH AND IS USED FOR TRAVELTIME CALCULATIONS.

CHANNEL FLOW THRU SUBAREA(CFS) =    235.51
FLOW VELOCITY(FEET/SEC.) = 15.70 FLOW DEPTH(FEET) =    1.00
TRAVEL TIME(MIN.) =    0.10 Tc(MIN.) =    14.31
LONGEST FLOWPATH FROM NODE      20.00 TO NODE      16.00 =    2875.00 FEET.

*****
FLOW PROCESS FROM NODE      16.00 TO NODE      16.00 IS CODE =  10
-----
>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<
=====

*****
FLOW PROCESS FROM NODE      10.00 TO NODE      11.00 IS CODE =  21
-----
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
=====
RESIDENTIAL (2. DU/AC OR LESS) RUNOFF COEFFICIENT = .3800
SOIL CLASSIFICATION IS "B"
S.C.S. CURVE NUMBER (AMC II) =    68
INITIAL SUBAREA FLOW-LENGTH(FEET) =    130.00
UPSTREAM ELEVATION(FEET) =    732.00
DOWNSTREAM ELEVATION(FEET) =    725.00
ELEVATION DIFFERENCE(FEET) =    7.00
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.395
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
THE MAXIMUM OVERLAND FLOW LENGTH = 100.00
(Reference: Table 3-1B of Hydrology Manual)
THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 7.165
SUBAREA RUNOFF(CFS) =    0.54
TOTAL AREA(ACRES) =    0.20 TOTAL RUNOFF(CFS) =    0.54

*****
FLOW PROCESS FROM NODE      11.00 TO NODE      12.00 IS CODE =  51
-----
>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<
```

>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<

ELEVATION DATA: UPSTREAM(FEET) = 725.00 DOWNSTREAM(FEET) = 485.00  
CHANNEL LENGTH THRU SUBAREA(FEET) = 1720.00 CHANNEL SLOPE = 0.1395  
CHANNEL BASE(FEET) = 5.00 "Z" FACTOR = 5.000  
MANNING'S FACTOR = 0.030 MAXIMUM DEPTH(FEET) = 1.00  
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 5.612  
RESIDENTIAL (2. DU/AC OR LESS) RUNOFF COEFFICIENT = .3800  
SOIL CLASSIFICATION IS "B"  
S.C.S. CURVE NUMBER (AMC II) = 68  
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 23.55  
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 8.42  
AVERAGE FLOW DEPTH(FEET) = 0.40 TRAVEL TIME(MIN.) = 3.40  
Tc(MIN.) = 10.80  
SUBAREA AREA(ACRES) = 21.30 SUBAREA RUNOFF(CFS) = 45.42  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.380  
TOTAL AREA(ACRES) = 21.5 PEAK FLOW RATE(CFS) = 45.85

END OF SUBAREA CHANNEL FLOW HYDRAULICS:

DEPTH(FEET) = 0.57 FLOW VELOCITY(FEET/SEC.) = 10.26  
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 12.00 = 1850.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 12.00 TO NODE 15.00 IS CODE = 61

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<  
>>>>(STANDARD CURB SECTION USED)<<<<

UPSTREAM ELEVATION(FEET) = 485.00 DOWNSTREAM ELEVATION(FEET) = 466.30  
STREET LENGTH(FEET) = 380.00 CURB HEIGHT(INCHES) = 6.0  
STREET HALFWIDTH(FEET) = 12.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 7.00  
INSIDE STREET CROSSFALL(DECIMAL) = 0.020  
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 2  
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020  
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = 0.0150  
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

\*\*TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 47.64  
\*\*\*STREET FLOWING FULL\*\*\*

STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:

STREET FLOW DEPTH(FEET) = 0.48  
HALFSTREET FLOOD WIDTH(FEET) = 12.00  
AVERAGE FLOW VELOCITY(FEET/SEC.) = 8.26  
PRODUCT OF DEPTH&VELOCITY(FT\*FT/SEC.) = 3.94

STREET FLOW TRAVEL TIME(MIN.) = 0.77 Tc(MIN.) = 11.57  
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 5.369

\*USER SPECIFIED(SUBAREA):

RESIDENTIAL (2. DU/AC OR LESS) RUNOFF COEFFICIENT = .7400

S.C.S. CURVE NUMBER (AMC II) = 68

AREA-AVERAGE RUNOFF COEFFICIENT = 0.394

SUBAREA AREA(ACRES) = 0.90 SUBAREA RUNOFF(CFS) = 3.58  
TOTAL AREA(ACRES) = 22.4 PEAK FLOW RATE(CFS) = 47.44

END OF SUBAREA STREET FLOW HYDRAULICS:

DEPTH(FEET) = 0.48 HALFSTREET FLOOD WIDTH(FEET) = 12.00  
FLOW VELOCITY(FEET/SEC.) = 8.23 DEPTH\*VELOCITY(FT\*FT/SEC.) = 3.92  
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 15.00 = 2230.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 15.00 TO NODE 16.00 IS CODE = 41

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<  
>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<

ELEVATION DATA: UPSTREAM(FEET) = 461.30 DOWNSTREAM(FEET) = 457.30  
FLOW LENGTH(FEET) = 235.00 MANNING'S N = 0.013  
DEPTH OF FLOW IN 30.0 INCH PIPE IS 23.0 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 11.75  
GIVEN PIPE DIAMETER(INCH) = 30.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 47.44  
PIPE TRAVEL TIME(MIN.) = 0.33 Tc(MIN.) = 11.90  
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 16.00 = 2465.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 16.00 TO NODE 16.00 IS CODE = 11

>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<

\*\* MAIN STREAM CONFLUENCE DATA \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	47.44	11.90	5.272	22.40
LONGEST FLOWPATH FROM NODE		10.00 TO NODE	16.00	= 2465.00 FEET.

\*\* MEMORY BANK # 1 CONFLUENCE DATA \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	235.51	14.31	4.680	155.76
LONGEST FLOWPATH FROM NODE		20.00 TO NODE	16.00	= 2875.00 FEET.

\*\* PEAK FLOW RATE TABLE \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)
1	243.29	11.90	5.272
2	277.63	14.31	4.680

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 277.63 Tc(MIN.) = 14.31  
TOTAL AREA(ACRES) = 178.2

\*\*\*\*\*  
FLOW PROCESS FROM NODE 16.00 TO NODE 16.00 IS CODE = 12

>>>>CLEAR MEMORY BANK # 1 <<<<

\*\*\*\*\*  
FLOW PROCESS FROM NODE 16.00 TO NODE 13.00 IS CODE = 51

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<

>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<

ELEVATION DATA: UPSTREAM(FEET) = 457.30 DOWNSTREAM(FEET) = 455.90  
CHANNEL LENGTH THRU SUBAREA(FEET) = 125.00 CHANNEL SLOPE = 0.0112  
CHANNEL BASE(FEET) = 10.00 "Z" FACTOR = 5.000  
MANNING'S FACTOR = 0.030 MAXIMUM DEPTH(FEET) = 1.00

==>>WARNING: FLOW IN CHANNEL EXCEEDS CHANNEL  
CAPACITY( NORMAL DEPTH EQUAL TO SPECIFIED MAXIMUM  
ALLOWABLE DEPTH).  
AS AN APPROXIMATION, FLOWDEPTH IS SET AT MAXIMUM  
ALLOWABLE DEPTH AND IS USED FOR TRAVELTIME CALCULATIONS.

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.657  
RESIDENTIAL (2. DU/AC OR LESS) RUNOFF COEFFICIENT = .3800  
SOIL CLASSIFICATION IS "B"  
S.C.S. CURVE NUMBER (AMC II) = 68  
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 278.07  
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 18.54  
AVERAGE FLOW DEPTH(FEET) = 1.00 TRAVEL TIME(MIN.) = 0.11  
Tc(MIN.) = 14.42  
SUBAREA AREA(ACRES) = 0.50 SUBAREA RUNOFF(CFS) = 0.88  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.331  
TOTAL AREA(ACRES) = 178.7 PEAK FLOW RATE(CFS) = 277.63

==>>WARNING: FLOW IN CHANNEL EXCEEDS CHANNEL  
CAPACITY( NORMAL DEPTH EQUAL TO SPECIFIED MAXIMUM  
ALLOWABLE DEPTH).  
AS AN APPROXIMATION, FLOWDEPTH IS SET AT MAXIMUM  
ALLOWABLE DEPTH AND IS USED FOR TRAVELTIME CALCULATIONS.

END OF SUBAREA CHANNEL FLOW HYDRAULICS:

DEPTH(FEET) = 1.00 FLOW VELOCITY(FEET/SEC.) = 18.51

==>FLOWDEPTH EXCEEDS MAXIMUM ALLOWABLE DEPTH

LONGEST FLOWPATH FROM NODE 20.00 TO NODE 13.00 = 3000.00 FEET.

END OF STUDY SUMMARY:

TOTAL AREA(ACRES) = 178.7 TC(MIN.) = 14.42  
PEAK FLOW RATE(CFS) = 277.63

END OF RATIONAL METHOD ANALYSIS

**II. CALCULATIONS**

**B. DEVELOPED HYDROLOGY**

\*\*\*\*\*

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE  
Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT  
2003, 1985, 1981 HYDROLOGY MANUAL

(c) Copyright 1982-2007 Advanced Engineering Software (aes)  
Ver. 3.0 Release Date: 06/01/2007 License ID 1459

Analysis prepared by:

BHA INC.  
5115 AVENDIA ENCINAS, SUITE L  
CARLSBAD, CA 92008

\*\*\*\*\* DESCRIPTION OF STUDY \*\*\*\*\*

\* 1505 YORK DRIVE - W.O. 757-1019-400 \*  
\* DEVELOPED 100 YEAR HYDROLOGY \*  
\* DEVELOPED BASIN 1 \*

FILE NAME: K:\HYDRO\1019\DEV2A.DAT  
TIME/DATE OF STUDY: 17:16 03/25/2008

-----  
USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:  
-----

2003 SAN DIEGO MANUAL CRITERIA

USER SPECIFIED STORM EVENT(YEAR) = 100.00

6-HOUR DURATION PRECIPITATION (INCHES) = 3.500

SPECIFIED MINIMUM PIPE SIZE(INCH) = 8.00

SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90

SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD

NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS

\*USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL\*

NO.	HALF-CROWN TO WIDTH	CROSSFALL IN- / OUT-/PARK-	STREET-CROSSFALL: SIDE / SIDE/ WAY	CURB HEIGHT	GUTTER-GEOMETRIES: WIDTH	LIP	HIKE	FACTOR (n)
1	30.0	20.0	0.018/0.018/0.020	0.67	2.00	0.0313	0.167	0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

1. Relative Flow-Depth = 0.00 FEET

as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)

2. (Depth)\*(Velocity) Constraint = 6.0 (FT\*FT/S)

\*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN

OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.\*

\*\*\*\*\*

FLOW PROCESS FROM NODE 20.00 TO NODE 21.00 IS CODE = 21

----->>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<

RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .3200  
SOIL CLASSIFICATION IS "B"  
S.C.S. CURVE NUMBER (AMC II) = 65  
INITIAL SUBAREA FLOW-LENGTH(FEET) = 80.00  
UPSTREAM ELEVATION(FEET) = 644.50  
DOWNSTREAM ELEVATION(FEET) = 640.00  
ELEVATION DIFFERENCE(FEET) = 4.50  
SUBAREA OVERLAND TIME OF FLOW(MIN.) = 7.061  
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 7.381  
SUBAREA RUNOFF(CFS) = 0.38  
TOTAL AREA(ACRES) = 0.16 TOTAL RUNOFF(CFS) = 0.38

\*\*\*\*\*  
FLOW PROCESS FROM NODE 21.00 TO NODE 4.00 IS CODE = 51

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<  
>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<

ELEVATION DATA: UPSTREAM(FEET) = 640.00 DOWNSTREAM(FEET) = 459.50  
CHANNEL LENGTH THRU SUBAREA(FEET) = 2700.00 CHANNEL SLOPE = 0.0669  
CHANNEL BASE(FEET) = 20.00 "Z" FACTOR = 20.000  
MANNING'S FACTOR = 0.035 MAXIMUM DEPTH(FEET) = 1.00  
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 4.708  
RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .3200  
SOIL CLASSIFICATION IS "B"  
S.C.S. CURVE NUMBER (AMC II) = 65  
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 119.27  
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 6.32  
AVERAGE FLOW DEPTH(FEET) = 0.59 TRAVEL TIME(MIN.) = 7.12  
Tc(MIN.) = 14.18  
SUBAREA AREA(ACRES) = 152.40 SUBAREA RUNOFF(CFS) = 229.62  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.320  
TOTAL AREA(ACRES) = 152.6 PEAK FLOW RATE(CFS) = 229.86

END OF SUBAREA CHANNEL FLOW HYDRAULICS:

DEPTH(FEET) = 0.83 FLOW VELOCITY(FEET/SEC.) = 7.58  
LONGEST FLOWPATH FROM NODE 20.00 TO NODE 4.00 = 2780.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 4.00 TO NODE 4.00 IS CODE = 10

>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<

\*\*\*\*\*  
FLOW PROCESS FROM NODE 1.00 TO NODE 2.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<

RESIDENTIAL (2. DU/AC OR LESS) RUNOFF COEFFICIENT = .3800  
SOIL CLASSIFICATION IS "B"  
S.C.S. CURVE NUMBER (AMC II) = 68  
INITIAL SUBAREA FLOW-LENGTH(FEET) = 70.00  
UPSTREAM ELEVATION(FEET) = 636.20

DOWNSTREAM ELEVATION(FEET) = 625.00  
ELEVATION DIFFERENCE(FEET) = 11.20  
SUBAREA OVERLAND TIME OF FLOW(MIN.) = 5.033  
WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!  
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 9.182  
SUBAREA RUNOFF(CFS) = 0.35  
TOTAL AREA(ACRES) = 0.10 TOTAL RUNOFF(CFS) = 0.35

\*\*\*\*\*  
FLOW PROCESS FROM NODE 2.00 TO NODE 3.00 IS CODE = 51

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<  
>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<

ELEVATION DATA: UPSTREAM(FEET) = 625.00 DOWNSTREAM(FEET) = 496.00  
CHANNEL LENGTH THRU SUBAREA(FEET) = 640.00 CHANNEL SLOPE = 0.2016  
CHANNEL BASE(FEET) = 5.00 "Z" FACTOR = 5.000  
MANNING'S FACTOR = 0.030 MAXIMUM DEPTH(FEET) = 1.00  
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 7.172  
RESIDENTIAL (2. DU/AC OR LESS) RUNOFF COEFFICIENT = .3800  
SOIL CLASSIFICATION IS "B"  
S.C.S. CURVE NUMBER (AMC II) = 68  
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 2.55  
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 4.54  
AVERAGE FLOW DEPTH(FEET) = 0.10 TRAVEL TIME(MIN.) = 2.35  
Tc(MIN.) = 7.38  
SUBAREA AREA(ACRES) = 1.60 SUBAREA RUNOFF(CFS) = 4.36  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.380  
TOTAL AREA(ACRES) = 1.7 PEAK FLOW RATE(CFS) = 4.63

END OF SUBAREA CHANNEL FLOW HYDRAULICS:

DEPTH(FEET) = 0.14 FLOW VELOCITY(FEET/SEC.) = 5.71  
LONGEST FLOWPATH FROM NODE 1.00 TO NODE 3.00 = 710.00 FEET.

+-----+  
| BEGIN BROW DITCH CALCULATION |  
| BROW DITCH IS CALCULATED AS IF IT IS A |  
| 36-INCH PIPE FLOWING NO MORE THAN HALF FULL |  
+-----+

\*\*\*\*\*  
FLOW PROCESS FROM NODE 3.00 TO NODE 4.00 IS CODE = 41

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<  
>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<

ELEVATION DATA: UPSTREAM(FEET) = 496.00 DOWNSTREAM(FEET) = 457.50  
FLOW LENGTH(FEET) = 555.00 MANNING'S N = 0.030  
DEPTH OF FLOW IN 18.0 INCH PIPE IS 8.0 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 6.11  
GIVEN PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 4.63  
PIPE TRAVEL TIME(MIN.) = 1.51 Tc(MIN.) = 8.90  
LONGEST FLOWPATH FROM NODE 1.00 TO NODE 4.00 = 1265.00 FEET.

```
*****
FLOW PROCESS FROM NODE      3.00 TO NODE      4.00 IS CODE =  81
-----
>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
=====
100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.359
RESIDENTIAL (2. DU/AC OR LESS) RUNOFF COEFFICIENT = .3800
SOIL CLASSIFICATION IS "B"
S.C.S. CURVE NUMBER (AMC II) =  68
AREA-AVERAGE RUNOFF COEFFICIENT = 0.3800
SUBAREA AREA(ACRES) =      1.20    SUBAREA RUNOFF(CFS) =      2.90
TOTAL AREA(ACRES) =          2.9     TOTAL RUNOFF(CFS) =      7.01
TC(MIN.) =      8.90

*****
FLOW PROCESS FROM NODE      4.00 TO NODE      4.00 IS CODE =  11
-----
>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<
=====

** MAIN STREAM CONFLUENCE DATA **
STREAM    RUNOFF      Tc      INTENSITY      AREA
NUMBER    (CFS)      (MIN.)   (INCH/HOUR)   (ACRE)
        1       7.01      8.90      6.359       2.90
LONGEST FLOWPATH FROM NODE      1.00 TO NODE      4.00 =      1265.00 FEET.

** MEMORY BANK # 2 CONFLUENCE DATA **
STREAM    RUNOFF      Tc      INTENSITY      AREA
NUMBER    (CFS)      (MIN.)   (INCH/HOUR)   (ACRE)
        1      229.86     14.18      4.708      152.56
LONGEST FLOWPATH FROM NODE      20.00 TO NODE      4.00 =      2780.00 FEET.

** PEAK FLOW RATE TABLE **
STREAM    RUNOFF      Tc      INTENSITY
NUMBER    (CFS)      (MIN.)   (INCH/HOUR)
        1      151.27     8.90      6.359
        2      235.05     14.18      4.708

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =      235.05    Tc(MIN.) =      14.18
TOTAL AREA(ACRES) =          155.5

*****
FLOW PROCESS FROM NODE      4.00 TO NODE      4.00 IS CODE =  12
-----
>>>>CLEAR MEMORY BANK # 2 <<<<
=====

***** 
FLOW PROCESS FROM NODE      4.00 TO NODE      27.00 IS CODE =  51
-----
>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<
>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<
```

=====  
ELEVATION DATA: UPSTREAM(FEET) = 457.50 DOWNSTREAM(FEET) = 457.30  
CHANNEL LENGTH THRU SUBAREA(FEET) = 95.00 CHANNEL SLOPE = 0.0021  
CHANNEL BASE(FEET) = 10.00 "Z" FACTOR = 5.000  
MANNING'S FACTOR = 0.030 MAXIMUM DEPTH(FEET) = 1.00

==>>WARNING: FLOW IN CHANNEL EXCEEDS CHANNEL  
CAPACITY( NORMAL DEPTH EQUAL TO SPECIFIED MAXIMUM  
ALLOWABLE DEPTH).  
AS AN APPROXIMATION, FLOWDEPTH IS SET AT MAXIMUM  
ALLOWABLE DEPTH AND IS USED FOR TRAVELTIME CALCULATIONS.

CHANNEL FLOW THRU SUBAREA(CFS) = 235.05  
FLOW VELOCITY(FEET/SEC.) = 15.67 FLOW DEPTH(FEET) = 1.00  
TRAVEL TIME(MIN.) = 0.10 Tc(MIN.) = 14.28  
LONGEST FLOWPATH FROM NODE 20.00 TO NODE 27.00 = 2875.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 27.00 TO NODE 27.00 IS CODE = 10

>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<

\*\*\*\*\*  
FLOW PROCESS FROM NODE 10.00 TO NODE 11.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<

RESIDENTIAL (2. DU/AC OR LESS) RUNOFF COEFFICIENT = .3800  
SOIL CLASSIFICATION IS "B"  
S.C.S. CURVE NUMBER (AMC II) = 68  
INITIAL SUBAREA FLOW-LENGTH(FEET) = 130.00  
UPSTREAM ELEVATION(FEET) = 732.00  
DOWNSTREAM ELEVATION(FEET) = 725.00  
ELEVATION DIFFERENCE(FEET) = 7.00  
SUBAREA OVERLAND TIME OF FLOW(MIN.) = 7.395  
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN  
THE MAXIMUM OVERLAND FLOW LENGTH = 100.00  
(Reference: Table 3-1B of Hydrology Manual)  
THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!  
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 7.165  
SUBAREA RUNOFF(CFS) = 0.54  
TOTAL AREA(ACRES) = 0.20 TOTAL RUNOFF(CFS) = 0.54

\*\*\*\*\*  
FLOW PROCESS FROM NODE 11.00 TO NODE 12.00 IS CODE = 51

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<  
>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<

=====  
ELEVATION DATA: UPSTREAM(FEET) = 725.00 DOWNSTREAM(FEET) = 485.30  
CHANNEL LENGTH THRU SUBAREA(FEET) = 1720.00 CHANNEL SLOPE = 0.1394  
CHANNEL BASE(FEET) = 5.00 "Z" FACTOR = 5.000  
MANNING'S FACTOR = 0.030 MAXIMUM DEPTH(FEET) = 1.00

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 5.612  
RESIDENTIAL (2. DU/AC OR LESS) RUNOFF COEFFICIENT = .3800  
SOIL CLASSIFICATION IS "B"  
S.C.S. CURVE NUMBER (AMC II) = 68  
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 23.55  
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 8.42  
AVERAGE FLOW DEPTH(FEET) = 0.40 TRAVEL TIME(MIN.) = 3.40  
Tc(MIN.) = 10.80  
SUBAREA AREA(ACRES) = 21.30 SUBAREA RUNOFF(CFS) = 45.42  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.380  
TOTAL AREA(ACRES) = 21.5 PEAK FLOW RATE(CFS) = 45.85

END OF SUBAREA CHANNEL FLOW HYDRAULICS:

DEPTH(FEET) = 0.57 FLOW VELOCITY(FEET/SEC.) = 10.26  
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 12.00 = 1850.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 12.00 TO NODE 12.10 IS CODE = 41  
-----

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<  
>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<

ELEVATION DATA: UPSTREAM(FEET) = 485.30 DOWNSTREAM(FEET) = 483.80  
FLOW LENGTH(FEET) = 36.36 MANNING'S N = 0.024  
ASSUME FULL-FLOWING PIPELINE  
PIPE-FLOW VELOCITY(FEET/SEC.) = 25.95  
PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)  
GIVEN PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 45.85  
PIPE TRAVEL TIME(MIN.) = 0.02 Tc(MIN.) = 10.82  
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 12.10 = 1886.36 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 12.10 TO NODE 15.00 IS CODE = 41  
-----

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<  
>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<

ELEVATION DATA: UPSTREAM(FEET) = 480.70 DOWNSTREAM(FEET) = 477.00  
FLOW LENGTH(FEET) = 133.00 MANNING'S N = 0.013  
DEPTH OF FLOW IN 30.0 INCH PIPE IS 18.6 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 14.33  
GIVEN PIPE DIAMETER(INCH) = 30.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 45.85  
PIPE TRAVEL TIME(MIN.) = 0.15 Tc(MIN.) = 10.98  
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 15.00 = 2019.36 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 15.00 TO NODE 15.00 IS CODE = 1  
-----

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<

TOTAL NUMBER OF STREAMS = 2  
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:

TIME OF CONCENTRATION(MIN.) = 10.98  
RAINFALL INTENSITY(INCH/HR) = 5.55  
TOTAL STREAM AREA(ACRES) = 21.50  
PEAK FLOW RATE(CFS) AT CONFLUENCE = 45.85

\*\*\*\*\*

FLOW PROCESS FROM NODE 13.00 TO NODE 14.00 IS CODE = 21

-----

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<

=====

\*USER SPECIFIED(SUBAREA):

RESIDENTIAL (2. DU/AC OR LESS) RUNOFF COEFFICIENT = .9500

S.C.S. CURVE NUMBER (AMC II) = 68

INITIAL SUBAREA FLOW-LENGTH(FEET) = 100.00

UPSTREAM ELEVATION(FEET) = 493.80

DOWNSTREAM ELEVATION(FEET) = 486.60

ELEVATION DIFFERENCE(FEET) = 7.20

SUBAREA OVERLAND TIME OF FLOW(MIN.) = 1.398

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 9.222

NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.

SUBAREA RUNOFF(CFS) = 0.44

TOTAL AREA(ACRES) = 0.05 TOTAL RUNOFF(CFS) = 0.44

\*\*\*\*\*

FLOW PROCESS FROM NODE 14.00 TO NODE 15.00 IS CODE = 61

-----

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<

>>>>(STANDARD CURB SECTION USED)<<<<

=====

UPSTREAM ELEVATION(FEET) = 486.60 DOWNSTREAM ELEVATION(FEET) = 485.00

STREET LENGTH(FEET) = 155.00 CURB HEIGHT(INCHES) = 6.0

STREET HALFWIDTH(FEET) = 20.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 15.00

INSIDE STREET CROSSFALL(DECIMAL) = 0.020

OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1

STREET PARKWAY CROSSFALL(DECIMAL) = 0.020

Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = 0.0150

Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

\*\*TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 1.14

STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:

STREET FLOW DEPTH(FEET) = 0.26

HALFSTREET FLOOD WIDTH(FEET) = 6.90

AVERAGE FLOW VELOCITY(FEET/SEC.) = 1.91

PRODUCT OF DEPTH&VELOCITY(FT\*FT/SEC.) = 0.51

STREET FLOW TRAVEL TIME(MIN.) = 1.35 Tc(MIN.) = 2.75

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 9.222

NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.

\*USER SPECIFIED(SUBAREA):

RESIDENTIAL (2. DU/AC OR LESS) RUNOFF COEFFICIENT = .9500

S.C.S. CURVE NUMBER (AMC II) = 68

AREA-AVERAGE RUNOFF COEFFICIENT = 0.950  
SUBAREA AREA(ACRES) = 0.16 SUBAREA RUNOFF(CFS) = 1.40  
TOTAL AREA(ACRES) = 0.2 PEAK FLOW RATE(CFS) = 1.84

END OF SUBAREA STREET FLOW HYDRAULICS:

DEPTH(FEET) = 0.30 HALFSTREET FLOOD WIDTH(FEET) = 8.66  
FLOW VELOCITY(FEET/SEC.) = 2.12 DEPTH\*VELOCITY(FT\*FT/SEC.) = 0.63  
LONGEST FLOWPATH FROM NODE 13.00 TO NODE 15.00 = 255.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 15.00 TO NODE 15.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<  
>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<

TOTAL NUMBER OF STREAMS = 2  
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:  
TIME OF CONCENTRATION(MIN.) = 2.75  
RAINFALL INTENSITY(INCH/HR) = 9.22  
TOTAL STREAM AREA(ACRES) = 0.21  
PEAK FLOW RATE(CFS) AT CONFLUENCE = 1.84

\*\* CONFLUENCE DATA \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	45.85	10.98	5.553	21.50
2	1.84	2.75	9.222	0.21

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO  
CONFLUENCE FORMULA USED FOR 2 STREAMS.

\*\* PEAK FLOW RATE TABLE \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)
1	13.32	2.75	9.222
2	46.96	10.98	5.553

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 46.96 Tc(MIN.) = 10.98  
TOTAL AREA(ACRES) = 21.7  
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 15.00 = 2019.36 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 15.00 TO NODE 15.10 IS CODE = 41

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<  
>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<

ELEVATION DATA: UPSTREAM(FEET) = 476.70 DOWNSTREAM(FEET) = 473.20  
FLOW LENGTH(FEET) = 20.30 MANNING'S N = 0.013  
DEPTH OF FLOW IN 30.0 INCH PIPE IS 11.1 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 28.52  
GIVEN PIPE DIAMETER(INCH) = 30.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 46.96

PIPE TRAVEL TIME(MIN.) = 0.01 Tc(MIN.) = 10.99  
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 15.10 = 2039.66 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 15.10 TO NODE 15.20 IS CODE = 41

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<  
>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<

ELEVATION DATA: UPSTREAM(FEET) = 473.20 DOWNSTREAM(FEET) = 461.90  
FLOW LENGTH(FEET) = 187.62 MANNING'S N = 0.013  
DEPTH OF FLOW IN 30.0 INCH PIPE IS 14.9 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 19.37  
GIVEN PIPE DIAMETER(INCH) = 30.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 46.96  
PIPE TRAVEL TIME(MIN.) = 0.16 Tc(MIN.) = 11.15  
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 15.20 = 2227.28 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 15.20 TO NODE 18.10 IS CODE = 41

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<  
>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<

ELEVATION DATA: UPSTREAM(FEET) = 461.70 DOWNSTREAM(FEET) = 460.94  
FLOW LENGTH(FEET) = 56.48 MANNING'S N = 0.013  
DEPTH OF FLOW IN 24.0 INCH PIPE IS 18.5 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 9.01  
GIVEN PIPE DIAMETER(INCH) = 24.00 NUMBER OF PIPES = 2  
PIPE-FLOW(CFS) = 46.96  
PIPE TRAVEL TIME(MIN.) = 0.10 Tc(MIN.) = 11.25  
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 18.10 = 2283.76 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 18.10 TO NODE 18.10 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<

TOTAL NUMBER OF STREAMS = 2  
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:  
TIME OF CONCENTRATION(MIN.) = 11.25  
RAINFALL INTENSITY(INCH/HR) = 5.46  
TOTAL STREAM AREA(ACRES) = 21.71  
PEAK FLOW RATE(CFS) AT CONFLUENCE = 46.96

\*\*\*\*\*  
FLOW PROCESS FROM NODE 16.00 TO NODE 17.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<

\*USER SPECIFIED(SUBAREA):  
RESIDENTIAL (2. DU/AC OR LESS) RUNOFF COEFFICIENT = .8700  
S.C.S. CURVE NUMBER (AMC II) = 68  
INITIAL SUBAREA FLOW-LENGTH(FEET) = 100.00

UPSTREAM ELEVATION(FEET) = 484.00  
DOWNSTREAM ELEVATION(FEET) = 474.50  
ELEVATION DIFFERENCE(FEET) = 9.50  
SUBAREA OVERLAND TIME OF FLOW(MIN.) = 1.955  
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 9.222  
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.  
SUBAREA RUNOFF(CFS) = 0.64  
TOTAL AREA(ACRES) = 0.08 TOTAL RUNOFF(CFS) = 0.64

\*\*\*\*\*  
FLOW PROCESS FROM NODE 17.00 TO NODE 18.00 IS CODE = 61

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<  
>>>>(STANDARD CURB SECTION USED)<<<<

UPSTREAM ELEVATION(FEET) = 474.50 DOWNSTREAM ELEVATION(FEET) = 467.50  
STREET LENGTH(FEET) = 203.00 CURB HEIGHT(INCHES) = 6.0  
STREET HALFWIDTH(FEET) = 12.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 7.00  
INSIDE STREET CROSSFALL(DECIMAL) = 0.020  
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 2  
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020  
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = 0.0150  
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

\*\*TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 2.29  
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:  
STREET FLOW DEPTH(FEET) = 0.23  
HALFSTREET FLOOD WIDTH(FEET) = 4.97  
AVERAGE FLOW VELOCITY(FEET/SEC.) = 3.13  
PRODUCT OF DEPTH&VELOCITY(FT\*FT/SEC.) = 0.71  
STREET FLOW TRAVEL TIME(MIN.) = 1.08 Tc(MIN.) = 3.04  
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 9.222  
NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.  
\*USER SPECIFIED(SUBAREA):  
RESIDENTIAL (2. DU/AC OR LESS) RUNOFF COEFFICIENT = .5100  
S.C.S. CURVE NUMBER (AMC II) = 68  
AREA-AVERAGE RUNOFF COEFFICIENT = 0.547  
SUBAREA AREA(ACRES) = 0.70 SUBAREA RUNOFF(CFS) = 3.29  
TOTAL AREA(ACRES) = 0.8 PEAK FLOW RATE(CFS) = 3.93

END OF SUBAREA STREET FLOW HYDRAULICS:  
DEPTH(FEET) = 0.26 HALFSTREET FLOOD WIDTH(FEET) = 6.72  
FLOW VELOCITY(FEET/SEC.) = 3.45 DEPTH\*VELOCITY(FT\*FT/SEC.) = 0.90  
LONGEST FLOWPATH FROM NODE 16.00 TO NODE 18.00 = 303.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 18.00 TO NODE 18.10 IS CODE = 41

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<  
>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 461.70 DOWNSTREAM(FEET) = 461.34  
FLOW LENGTH(FEET) = 27.61 MANNING'S N = 0.013  
DEPTH OF FLOW IN 18.0 INCH PIPE IS 7.3 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 5.85  
GIVEN PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1  
PIPE-FLOW(CFS) = 3.93  
PIPE TRAVEL TIME(MIN.) = 0.08 Tc(MIN.) = 3.11  
LONGEST FLOWPATH FROM NODE 16.00 TO NODE 18.10 = 330.61 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 18.10 TO NODE 18.10 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<  
>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<

=====

TOTAL NUMBER OF STREAMS = 2  
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:  
TIME OF CONCENTRATION(MIN.) = 3.11  
RAINFALL INTENSITY(INCH/HR) = 9.22  
TOTAL STREAM AREA(ACRES) = 0.78  
PEAK FLOW RATE(CFS) AT CONFLUENCE = 3.93

\*\* CONFLUENCE DATA \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	46.96	11.25	5.464	21.71
2	3.93	3.11	9.222	0.78

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO  
CONFLUENCE FORMULA USED FOR 2 STREAMS.

\*\* PEAK FLOW RATE TABLE \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)
1	31.76	3.11	9.222
2	49.29	11.25	5.464

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 49.29 Tc(MIN.) = 11.25  
TOTAL AREA(ACRES) = 22.5  
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 18.10 = 2283.76 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 18.10 TO NODE 18.20 IS CODE = 41

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<  
>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 460.84 DOWNSTREAM(FEET) = 458.43  
FLOW LENGTH(FEET) = 178.37 MANNING'S N = 0.013  
DEPTH OF FLOW IN 24.0 INCH PIPE IS 19.4 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 9.05  
GIVEN PIPE DIAMETER(INCH) = 24.00 NUMBER OF PIPES = 2

PIPE-FLOW(CFS) = 49.29  
PIPE TRAVEL TIME(MIN.) = 0.33 Tc(MIN.) = 11.58  
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 18.20 = 2462.13 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 18.20 TO NODE 27.00 IS CODE = 41

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<  
>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<

ELEVATION DATA: UPSTREAM(FEET) = 458.33 DOWNSTREAM(FEET) = 457.99  
FLOW LENGTH(FEET) = 25.29 MANNING'S N = 0.013  
DEPTH OF FLOW IN 24.0 INCH PIPE IS 19.5 INCHES  
PIPE-FLOW VELOCITY(FEET/SEC.) = 9.03  
GIVEN PIPE DIAMETER(INCH) = 24.00 NUMBER OF PIPES = 2  
PIPE-FLOW(CFS) = 49.29  
PIPE TRAVEL TIME(MIN.) = 0.05 Tc(MIN.) = 11.63  
LONGEST FLOWPATH FROM NODE 10.00 TO NODE 27.00 = 2487.42 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 27.00 TO NODE 27.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<

TOTAL NUMBER OF STREAMS = 2  
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:  
TIME OF CONCENTRATION(MIN.) = 11.63  
RAINFALL INTENSITY(INCH/HR) = 5.35  
TOTAL STREAM AREA(ACRES) = 22.49  
PEAK FLOW RATE(CFS) AT CONFLUENCE = 49.29

\*\*\*\*\*  
FLOW PROCESS FROM NODE 25.00 TO NODE 26.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<

RESIDENTIAL (2. DU/AC OR LESS) RUNOFF COEFFICIENT = .3800  
SOIL CLASSIFICATION IS "B"  
S.C.S. CURVE NUMBER (AMC II) = 68  
INITIAL SUBAREA FLOW-LENGTH(FEET) = 73.00  
UPSTREAM ELEVATION(FEET) = 467.50  
DOWNSTREAM ELEVATION(FEET) = 461.00  
ELEVATION DIFFERENCE(FEET) = 6.50  
SUBAREA OVERLAND TIME OF FLOW(MIN.) = 5.343  
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 8.835  
SUBAREA RUNOFF(CFS) = 0.24  
TOTAL AREA(ACRES) = 0.07 TOTAL RUNOFF(CFS) = 0.24

\*\*\*\*\*  
FLOW PROCESS FROM NODE 26.00 TO NODE 27.00 IS CODE = 51

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<  
>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<

ELEVATION DATA: UPSTREAM(FEET) = 465.00 DOWNSTREAM(FEET) = 463.40  
 CHANNEL LENGTH THRU SUBAREA(FEET) = 160.00 CHANNEL SLOPE = 0.0100  
 CHANNEL BASE(FEET) = 0.00 "Z" FACTOR = 6.000  
 MANNING'S FACTOR = 0.022 MAXIMUM DEPTH(FEET) = 0.50  
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 7.488  
 RESIDENTIAL (2. DU/AC OR LESS) RUNOFF COEFFICIENT = .3800  
 SOIL CLASSIFICATION IS "B"  
 S.C.S. CURVE NUMBER (AMC II) = 68  
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 0.66  
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 1.71  
 AVERAGE FLOW DEPTH(FEET) = 0.25 TRAVEL TIME(MIN.) = 1.56  
 Tc(MIN.) = 6.91  
 SUBAREA AREA(ACRES) = 0.30 SUBAREA RUNOFF(CFS) = 0.85  
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.380  
 TOTAL AREA(ACRES) = 0.4 PEAK FLOW RATE(CFS) = 1.05

END OF SUBAREA CHANNEL FLOW HYDRAULICS:

DEPTH(FEET) = 0.30 FLOW VELOCITY(FEET/SEC.) = 1.92  
 LONGEST FLOWPATH FROM NODE 25.00 TO NODE 27.00 = 233.00 FEET.

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 27.00 TO NODE 27.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<  
 >>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<

TOTAL NUMBER OF STREAMS = 2  
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:  
 TIME OF CONCENTRATION(MIN.) = 6.91  
 RAINFALL INTENSITY(INCH/HR) = 7.49  
 TOTAL STREAM AREA(ACRES) = 0.37  
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 1.05

\*\* CONFLUENCE DATA \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	49.29	11.63	5.350	22.49
2	1.05	6.91	7.488	0.37

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO  
 CONFLUENCE FORMULA USED FOR 2 STREAMS.

\*\* PEAK FLOW RATE TABLE \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)
1	36.27	6.91	7.488
2	50.04	11.63	5.350

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 50.04 Tc(MIN.) = 11.63  
 TOTAL AREA(ACRES) = 22.9  
 LONGEST FLOWPATH FROM NODE 10.00 TO NODE 27.00 = 2487.42 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 27.00 TO NODE 27.00 IS CODE = 11

>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<

\*\* MAIN STREAM CONFLUENCE DATA \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	50.04	11.63	5.350	22.86
LONGEST FLOWPATH FROM NODE		10.00 TO NODE	27.00	= 2487.42 FEET.

\*\* MEMORY BANK # 1 CONFLUENCE DATA \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	235.05	14.28	4.687	155.46
LONGEST FLOWPATH FROM NODE		20.00 TO NODE	27.00	= 2875.00 FEET.

\*\* PEAK FLOW RATE TABLE \*\*

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)
1	241.49	11.63	5.350
2	278.89	14.28	4.687

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 278.89 Tc(MIN.) = 14.28

TOTAL AREA(ACRES) = 178.3

END OF STUDY SUMMARY:

TOTAL AREA(ACRES) = 178.3 TC(MIN.) = 14.28

PEAK FLOW RATE(CFS) = 278.89

END OF RATIONAL METHOD ANALYSIS

## II. CALCULATIONS

### C. EXISTING 100 YEAR FLOOD INUNDATION (HEC-RAS)

## HEC-RAS Plan: EXINUNDATION River: 1 Reach: 1 Profile: PF 1

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chnl
1	12	PF 1	235.50	459.39	460.92	461.15	0.005397	4.39	68.33	87.92	0.67	
1	11	PF 1	235.50	459.48	460.55	460.82	0.010436	4.65	62.49	114.95	0.87	
1	10	PF 1	235.50	458.45	459.63	459.79	0.004667	3.43	77.36	105.15	0.60	
1	9	PF 1	235.50	458.43	459.36	459.68	0.011974	4.69	55.57	94.31	0.92	
1	8	PF 1	235.50	457.87	458.97	459.12	0.005967	3.25	78.52	122.28	0.65	
1	7	PF 1	277.60	457.49	458.61	458.83	0.006673	4.11	78.03	106.89	0.72	
1	6	PF 1	277.60	457.10	458.29	458.50	0.006483	3.96	83.43	137.79	0.70	
1	5	PF 1	277.60	456.98	457.97	457.88	0.009001	3.66	80.03	136.12	0.78	
1	4	PF 1	277.60	456.54	457.41	457.41	0.016935	3.85	73.36	168.85	1.00	
1	3	PF 1	277.60	455.89	456.82	456.97	0.006530	3.30	93.53	160.96	0.67	
1	2	PF 1	277.60	455.48	456.39	456.39	0.012808	4.19	71.72	145.38	0.92	
1	1	PF 1	277.60	454.64	455.59	455.59	0.015528	4.30	65.41	118.09	0.59	

EXBRMODB.rep

HEC-RAS Version 3.1.3 May 2005  
U.S. Army Corp of Engineers  
Hydrologic Engineering Center  
609 Second Street  
Davis, California

X	X	XXXXXX	XXXX	XXXX	XX	XXXX
X	X	X	X X	X X	X X	X
X	X	X	X	X X	X X	X
XXXXXXX	XXXX	X	XXX	XXXX	XXXXXX	XXXX
X	X	X	X	X X	X X	X
X	X	X	X X	X X	X X	X
X	X	XXXXXX	XXXX	X X	X X	XXXXX

PROJECT DATA

Project Title: EXISTING 100YR INUNDATION YORK DR

Project File : EXBRMODB.prj

Run Date and Time: 3/21/2008 1:36:43 PM

Project in English units

PLAN DATA

Plan Title: EXINUNDATION

Plan File : k:\Land Projects 3\757-1019-400\EXBRMODB.p04

Geometry Title: Imported Geom 02

Geometry File : k:\Land Projects 3\757-1019-400\EXBRMODB.g02

Flow Title : Imported Flow 02

Flow File : k:\Land Projects 3\757-1019-400\EXBRMODB.f02

Plan Summary Information:

Number of:	Cross Sections =	12	Multiple Openings =	0
	Culverts =	0	Inline Structures =	0
	Bridges =	0	Lateral Structures =	0

Computational Information

Water surface calculation tolerance = 0.01

Critical depth calculation tolerance = 0.01

Maximum number of iterations = 20

Maximum difference tolerance = 0.3

Flow tolerance factor = 0.001

Computation Options

Critical depth computed only where necessary

Conveyance Calculation Method: At breaks in n values only

Friction Slope Method: Average Conveyance

Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: Imported Flow 02

EXBRMODB.rep  
Flow File : k:\Land Projects 3\757-1019-400\EXBRMODB.f02

Flow Data (cfs)

River	Reach	RS	PF 1
1	1	12	235.5
1		7	277.6

Boundary Conditions

River Downstream	Reach	Profile	Upstream
1	1	PF 1	Critical

GEOMETRY DATA

Geometry Title: Imported Geom 02  
Geometry File : k:\Land Projects 3\757-1019-400\EXBRMODB.g02

CROSS SECTION

RIVER: 1  
REACH: 1 RS: 12

INPUT

Description: 11

Station	Elevation	Data	num=	27					
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	462.24	5.9	462.04	8.12	461.96	18.44	461.81	21.64	461.72
30.97	461.45	35.16	461.27	43.5	461.03	48.69	460.81	56.04	460.56
62.21	460.29	68.57	460.03	75.73	459.84	81.1	459.67	89.26	459.46
93.64	459.39	102.78	459.81	106.17	459.95	110.21	460.122	116.3	460.38
118.7	460.48	129.83	460.82	131.24	460.84	143.35	461.19	143.77	461.2
144.13	461.23	144.24	461.23						

Manning's n Values	num=	3			
Sta	n Val	Sta	n Val	Sta	n Val
0	.03	75.73	.03	102.78	.03

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	75.73	102.78		47.56	45.42	43.27	.1		.3

CROSS SECTION

RIVER: 1  
REACH: 1 RS: 11

INPUT

Description: 10

Station	Elevation	Data	num=	38					
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	462.46	.51	462.45	11.06	462.13	13.02	462.1	24.29	462.12

EXBRMODB.rep

25.54	462.14	37.51	461.72	38.06	461.66	47.71	461.1	50.58	460.92
50.74	460.91	63.09	460.53	63.96	460.51	75.43	459.9	75.61	459.89
77.19	459.85	88.13	459.48	90.41	459.48	100.65	459.62	103.64	459.67
113.17	459.81	116.86	459.87	125.68	459.99	130.09	459.99	138.2	460.13
143.31	460.07	150.72	460.13	156.54	460.31	163.34	460.34	169.76	460.5
175.76	460.48	182.98	460.76	188.27	460.84	196.21	460.9	200.79	460.97
209.43	461.95	213.31	462.27	214.21	462.54				

#### Manning's n Values

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	75.43	.03	116.86	.03

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	75.43	116.86		45.37	56.91	68.44	.1		.3

#### CROSS SECTION

RIVER: 1

REACH: 1

RS: 10

#### INPUT

Description: 9

Station	Elevation	Data	num=	45					
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev		
0	461.5	3.33	461.05	5.33	460.9	12.15	460.69	15.4	460.6
16.36	460.54	25.47	460.28	29.38	460.13	35.55	459.83	42.41	459.79
45.62	459.61	55.44	459.48	55.69	459.47	56.54	459.43	65.76	458.91
68.45	458.85	75.83	458.79	81.49	458.57	85.9	458.49	94.52	458.46
95.97	458.45	100.94	458.51	106.05	458.55	107.55	458.56	116.12	458.63
120.57	458.68	126.19	458.77	133.6	458.94	136.26	459.04	145.33	459.5
146.33	459.54	146.63	459.56	156.4	459.74	159.65	460.09	166.48	460.52
172.68	460.86	176.55	461.38	185.71	462.14	186.62	462.24	189.72	462.49
196.69	462.98	198.74	463.14	199.3	463.27	201.48	463.49	203.02	463.45

#### Manning's n Values

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	75.83	.03	133.6	.03

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	75.83	133.6		13.52	14.3	15.48	.1		.3

#### CROSS SECTION

RIVER: 1

REACH: 1

RS: 9

#### INPUT

Description: 8

Station	Elevation	Data	num=	46					
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev		
0	461.02	2.81	460.8	5.37	460.73	13.31	460.2	15.3	460.06
15.95	460.03	25.23	459.71	29.08	459.63	35.16	459.46	42.22	459.46
45.09	459.39	53.99	459.24	55.02	459.22	55.35	459.22	64.95	458.9
68.49	458.85	74.88	458.61	81.62	458.44	84.81	458.43	94.68	458.44
94.74	458.44	94.76	458.44	104.67	458.5	107.89	458.55	114.6	458.65
121.03	458.7	124.53	458.78	134.16	459.06	134.46	459.07	135.36	459.12
144.39	459.5	147.3	459.63	154.32	460.15	160.44	460.4	164.25	460.46
173.57	460.9	174.17	460.94	176.05	461.07	184.1	461.68	186.71	461.86
194.03	462.46	199.84	462.9	201.93	463.32	204.29	463.86	205.82	464.02
206.89	463.99								

EXBRMODB.rep

Manning's n Values	Sta	n Val	Sta	num=	3
	0	.03	68.49		.03
				Sta	n Val
				124.53	.03

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	68.49	124.53		43.1	44.1	45.1		.1	.3

#### CROSS SECTION

RIVER: 1  
REACH: 1 RS: 8

INPUT  
Description: 7  
Station Elevation Data num= 51

Sta	Elev								
0	461.42	3.42	461.16	9.68	460.59	16.71	460.31	19.44	460.11
27.01	459.63	29.21	459.47	30	459.44	38.97	459.09	43.29	458.93
48.74	458.77	56.58	458.53	58.5	458.49	63.81	458.35	68.26	458.27
69.87	458.24	78.03	458.17	83.16	458.16	87.79	458.2	96.45	458.23
97.55	458.22	100.6	458.23	107.32	458.21	109.74	458.2	117.08	457.99
123.03	457.87	126.85	457.99	136.32	458.44	136.61	458.43	137.4	458.42
146.37	458.24	149.61	458.29	156.14	458.61	162.9	458.87	165.9	459.04
174.2	459.46	175.66	459.55	176.19	459.57	185.43	460.53	189.48	460.98
195.19	461.36	202.78	461.84	204.96	462.04	210.99	462.68	214.72	463.06
216.07	463.19	224.48	463.87	229.36	464.36	234.25	464.81	237.8	465.08
239.25	465.29								

Manning's n Values	Sta	n Val	Sta	num=	3
	0	.03	69.87		.03
				Sta	n Val
				149.61	.03

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	69.87	149.61		45.86	43.79	41.71		.1	.3

#### CROSS SECTION

RIVER: 1  
REACH: 1 RS: 7

INPUT  
Description: 6  
Station Elevation Data num= 52

Sta	Elev								
0	460.65	1.9	460.52	9.15	460.24	11.98	460.12	12.81	460.09
22.06	459.63	25.83	459.46	32.14	459.27	38.85	458.97	42.22	458.87
51.88	458.69	52.3	458.68	53.75	458.66	62.38	458.45	64.9	458.39
72.46	458.17	77.92	457.97	82.54	457.87	90.94	457.78	92.62	457.74
98.36	457.61	102.7	457.51	103.96	457.49	112.78	457.54	116.98	457.56
122.86	457.59	130.01	457.61	132.93	457.57	142.97	457.62	143.01	457.62
143.03	457.62	153.09	458.23	156.05	458.35	163.17	458.62	169.07	458.82
173.25	459.08	182.09	459.84	183.33	459.92	187.57	460.2	193.41	460.6
195.11	460.76	203.49	461.58	208.14	462.07	213.57	462.59	221.16	463.46
223.65	463.68	232.18	464.44	233.73	464.52	234.18	464.56	243.81	465.17
245.29	465.3	245.87	465.37						

Manning's n Values	Sta	n Val	Sta	num=	3
	0	.03	90.94		.03
				Sta	n Val
				142.97	.03

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
				Page 4					

90.94 142.97 EXBRMODB.rep 52.23 50.04 47.84 .1 .3

#### CROSS SECTION

RIVER: 1

REACH: 1

RS: 6

#### INPUT

Description: 5

Station	Elevation	Data	num=	54	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	461.01	7.13		460.7	10.34	460.68	19.94	460.54	20.79	460.49		
24.54	460.39	31.24		460.17	32.76	460.12	41.7	459.59	45.57	459.43		
52.15	459.14	58.39		458.9	62.6	458.76	71.21	458.38	73.05	458.33		
81.21	458.05	83.5		457.97	84.02	457.96	93.95	457.76	96.84	457.72		
104.41	457.67	109.65		457.61	114.86	457.49	122.47	457.33	125.31	457.3		
135.28	457.2	135.76		457.2	137.88	457.21	146.21	457.28	148.1	457.25		
156.67	457.1	160.92		457.24	167.12	457.57	173.73	457.69	177.57	457.85		
186.55	458.23	188.02		458.24	194.54	458.17	198.47	458.13	199.36	458.12		
208.93	458.18	212.18		458.29	219.38	458.96	224.99	459.45	229.83	460.09		
237.81	461.11	240.28		461.25	250.63		462	250.73	462	251.31	462.03	
261.19	462.48	263.44		462.62	271.64	463.29	273.71	463.43				

Manning's n Values

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	109.65	.03	167.12	.03

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	109.65	167.12		39.17	42.84	46.5	.1	.3	

#### CROSS SECTION

RIVER: 1

REACH: 1

RS: 5

#### INPUT

Description:

Station	Elevation	Data	num=	49	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	459.65	2.22		459.55	7.02	459.41	12.55	459.21	19.89	458.88		
22.88	458.83	32.77		458.75	33.21	458.73	35.01	458.71	43.54	458.57		
45.64	458.6	53.87		458.32	58.52	458.25	64.2	458.04	71.39	457.78		
74.53	457.7	84.26		457.41	84.86	457.4	87.27	457.34	95.19	457.17		
97.14	457.16	105.51		457.13	110.01	457.13	115.84	457.13	122.88	456.98		
126.17	456.98	135.76		457.17	136.5	457.18	139.52	457.27	146.83	457.44		
148.63	457.47	157.16		457.51	161.51	457.51	167.49	457.49	174.38	457.39		
177.82	457.39	187.25		457.47	188.15	457.48	191.78	457.61	198.48	457.83		
200.13	457.89	208.81		458.22	213	458.4	219.14	458.87	225.87	459.41		
229.46	459.71	238.75		460.35	239.79	460.41	242.86	460.6				

Manning's n Values

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	84.86	.03	187.25	.03

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	84.86	187.25		44.27	44.2	44.1	.1	.3	

#### CROSS SECTION

RIVER: 1

## EXBRMODB.rep

REACH: 1

RS: 4

## INPUT

Description: 4

Station Elevation Data				num= 45			
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	458.15	6.28	458.04	10.23	457.94	11.2	457.89
24.07	457.41	30.89	457.23	36.95	457.3	41.21	457.16
51.54	456.91	58.53	456.74	61.87	456.64	62.7	456.62
75.57	456.75	82.53	456.74	88.44	456.7	92.86	456.54
103.19	457	110.79	457.19	113.52	457.26	114.19	457.23
127.06	456.93	134.18	456.99	139.94	456.93	144.51	456.88
154.83	456.88	163.05	456.99	165.16	457.01	165.69	457.02
178.56	457.15	185.82	457.24	191.43	457.34	196.15	457.53
206.48	457.78	215.31	458.06	216.81	458.11	217.18	458.12
							227.14
							458.49

Manning's n Values

num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	82.53	.03	178.56	.03

Bank Sta: Left Right  
82.53 178.56Lengths: Left Channel Right Coeff Contr. Expan.  
33.5 46.44 59.37 .1 .3

## CROSS SECTION

RIVER: 1

REACH: 1

RS: 3

## INPUT

Description: 3

Station Elevation Data				num= 46			
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	457.58	3.71	457.35	8.14	457.18	10.66	457.06
25.05	456.67	26.47	456.67	28.95	456.62	35.63	456.56
44.79	456.53	53.83	456.38	53.96	456.38	54.19	456.37
68.22	455.99	72.29	455.89	79.42	456.07	81.45	456.08
90.61	456.16	96.99	456.18	99.78	456.17	104.66	456.16
111.38	456.13	118.11	456.08	125.77	456	127.27	455.99
136.43	456.02	140.16	456.01	145.6	456.03	154.55	456.07
155.13	456.08	163.93	456.28	168.94	456.36	173.09	456.48
182.25	456.89	183.33	456.93	191.42	457.01	197.22	457.18
199.89	457.32						199.47
							457.29

Manning's n Values

num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	63.12	.03	154.55	.03

Bank Sta: Left Right  
63.12 154.55Lengths: Left Channel Right Coeff Contr. Expan.  
25.98 34.74 44.5 .1 .3

## CROSS SECTION

RIVER: 1

REACH: 1

RS: 2

## INPUT

Description: 2

Station Elevation Data				num= 45			
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	457.15	6.24	456.8	13.83	456.4	15.1	456.35
23.95	456.35	30.46	456.21	32.81	456.2	35.5	456.22
							16.54
							456.34
							41.67
							456.25

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47.08	456.14	50.53	455.999	54.46	455.91	59.369	455.69	63.71	455.63
68.24	455.48	73.41	455.68	77.1	455.81	80.34	455.72	85.96	455.6
92.37	455.72	94.82	455.76	96.96	455.8	103.67	455.8	111.33	455.81
112.53	455.8	113.59	455.81	121.39	455.8	130.21	455.79	130.25	455.79
130.29	455.79	139.11	455.81	146.84	455.79	147.96	455.78	149.24	455.83
156.82	456.1	163.47	456.85	165.68	456.98	168.2	457.15	174.54	457.32
180.09	457.5	183.39	457.58	187.16	457.68	192.25	457.75	193.19	457.75

#### Manning's n Values

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	54.46	.03	146.84	.03

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	54.46	146.84		57.43	54.61	51.79		.1	.3

#### CROSS SECTION

RIVER: 1

REACH: 1

RS: 1

#### INPUT

Description: 1

Station	Elevation	Data	num=	34			
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	456.65	2.25	456.58	10.31	456.39	11.12	456.38
19.98	456.14	28.29	455.7	29.49	455.69	37.71	455.9
48.66	455.16	55.43	455.32	61.26	455.29	67.83	455.4
77.75	455.48	87	455.1	90.89	454.91	94.24	454.87
106.17	454.72	108.62	454.72	110.72	454.81	117.48	454.75
152.94	454.64	156.62	455.037	160.18	455.42	163.69	455.68
176.67	456.79	179.53	457.13	182.86	457.31	188.39	457.54

#### Manning's n Values

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	44.78	.03	156.62	.03

Bank Sta:	Left	Right	Coeff	Contr.	Expan.
	44.78	156.62		.1	.3

#### SUMMARY OF MANNING'S N VALUES

River:1

Reach	River Sta.	n1	n2	n3
1	12	.03	.03	.03
1	11	.03	.03	.03
1	10	.03	.03	.03
1	9	.03	.03	.03
1	8	.03	.03	.03
1	7	.03	.03	.03
1	6	.03	.03	.03
1	5	.03	.03	.03
1	4	.03	.03	.03
1	3	.03	.03	.03
1	2	.03	.03	.03
1	1	.03	.03	.03

EXBRMODB.rep

SUMMARY OF REACH LENGTHS

River: 1

Reach	River Sta.	Left	Channel	Right
1	12	47.56	45.42	43.27
1	11	45.37	56.91	68.44
1	10	13.52	14.3	15.48
1	9	43.1	44.1	45.1
1	8	45.86	43.79	41.71
1	7	52.23	50.04	47.84
1	6	39.17	42.84	46.5
1	5	44.27	44.2	44.1
1	4	33.5	46.44	59.37
1	3	25.98	34.74	44.5
1	2	57.43	54.61	51.79
1	1			

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS

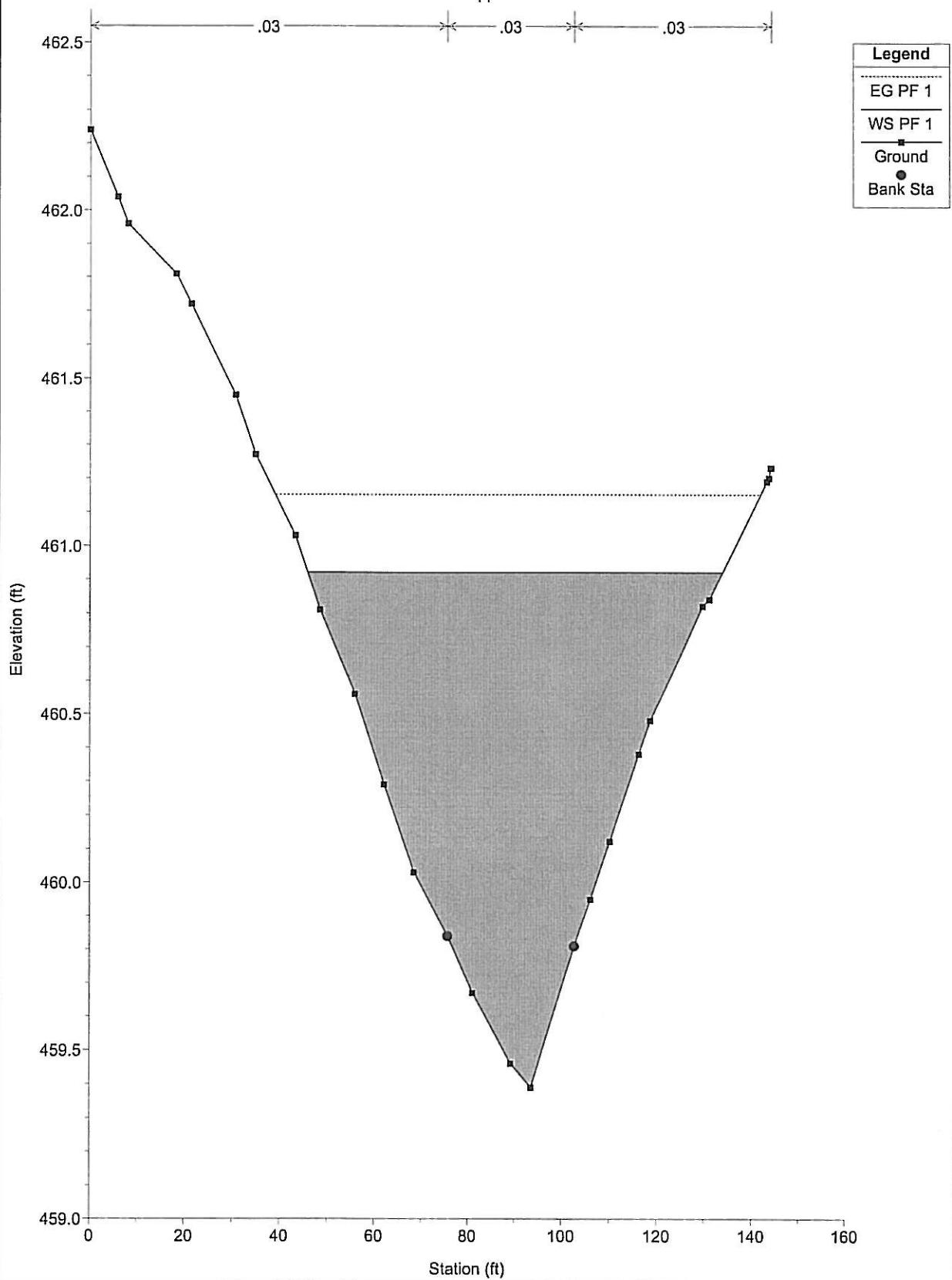
River: 1

Reach	River Sta.	Contr.	Expan.
1	12	.1	.3
1	11	.1	.3
1	10	.1	.3
1	9	.1	.3
1	8	.1	.3
1	7	.1	.3
1	6	.1	.3
1	5	.1	.3
1	4	.1	.3
1	3	.1	.3
1	2	.1	.3
1	1	.1	.3

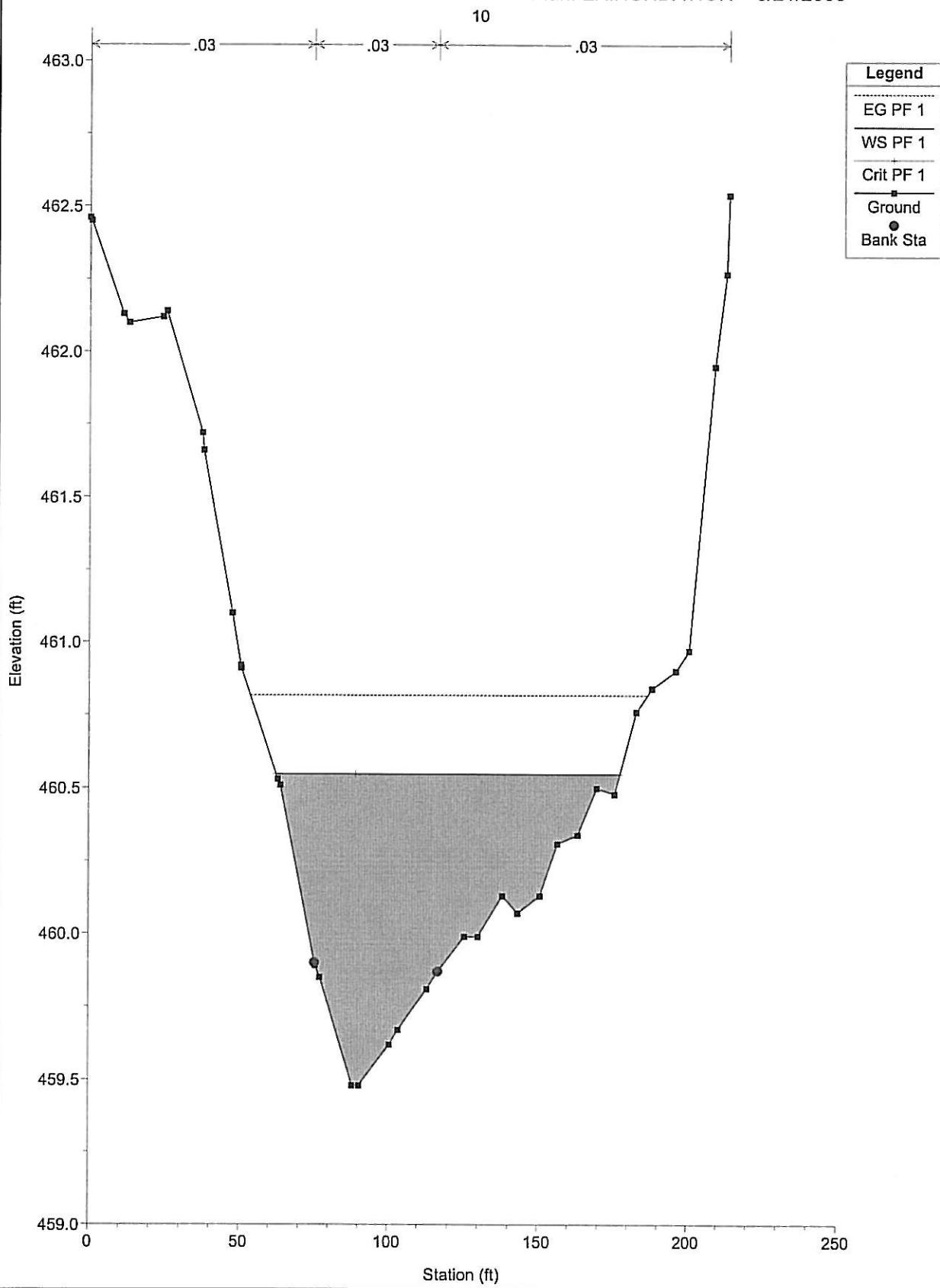
## EXISTING 100YR INUNDATION YORK DR

Plan: EXINUNDATION 3/21/2008

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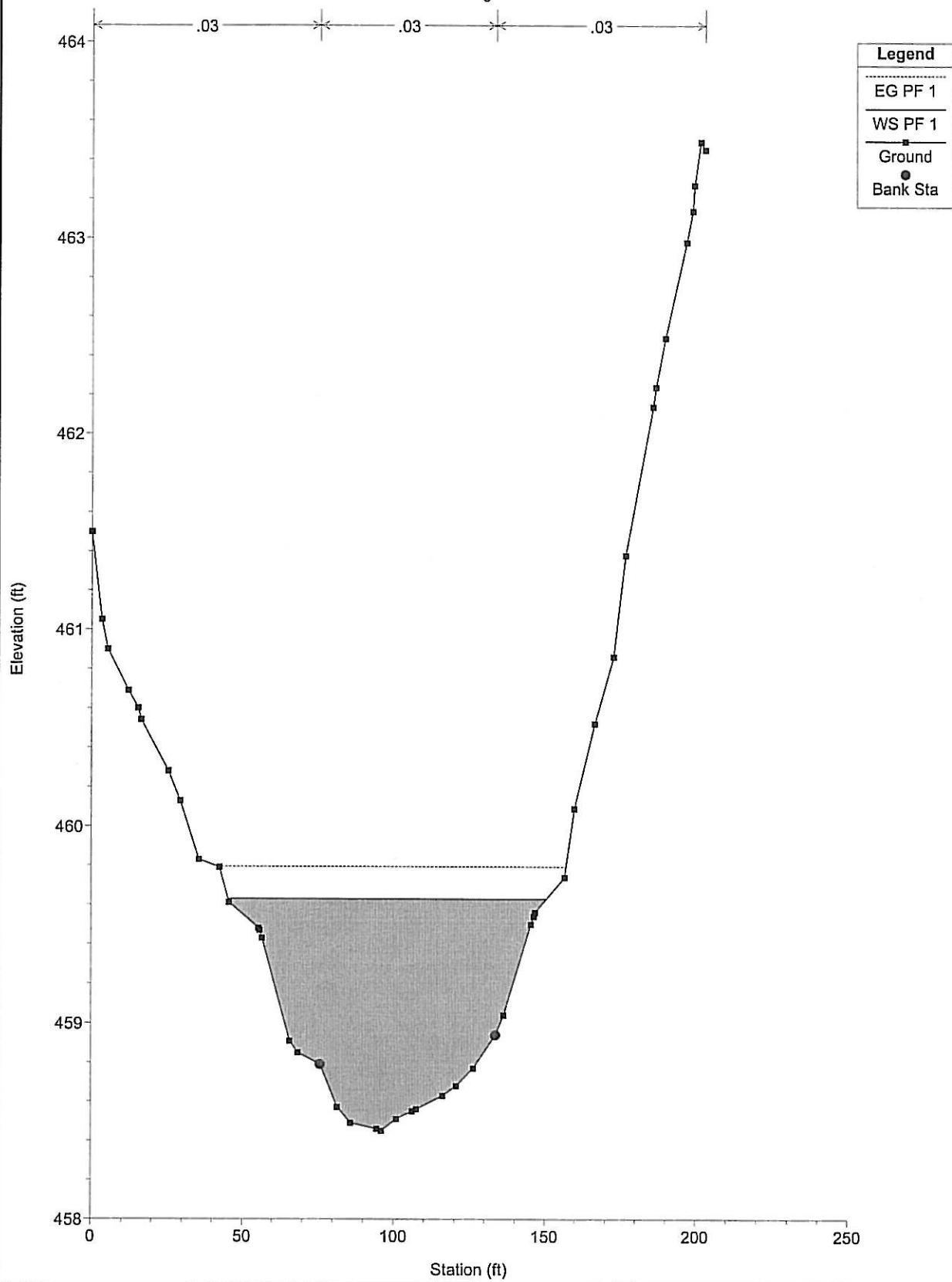


EXISTING 100YR INUNDATION YORK DR Plan: EXINUNDATION 3/21/2008



EXISTING 100YR INUNDATION YORK DR Plan: EXINUNDATION 3/21/2008

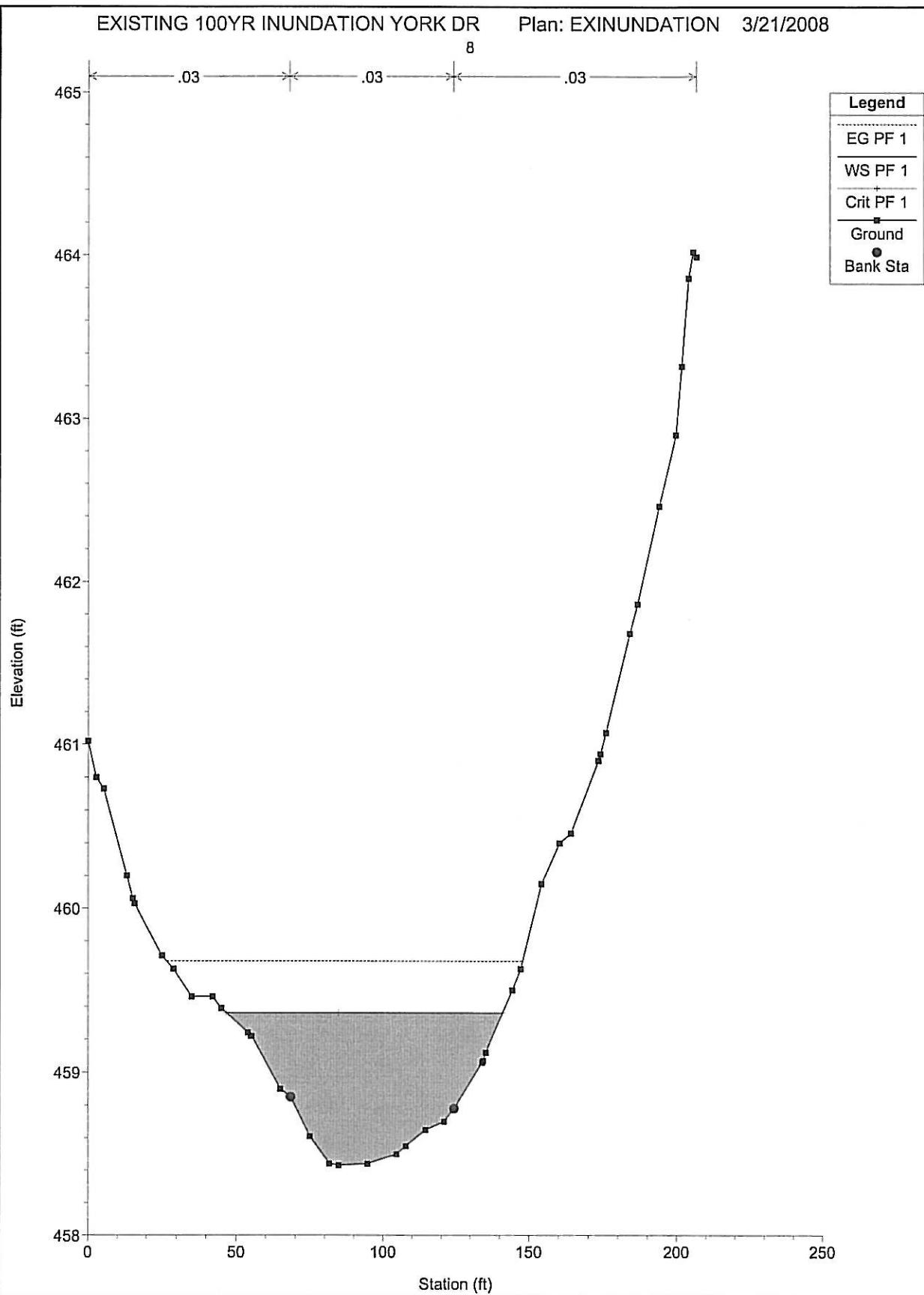
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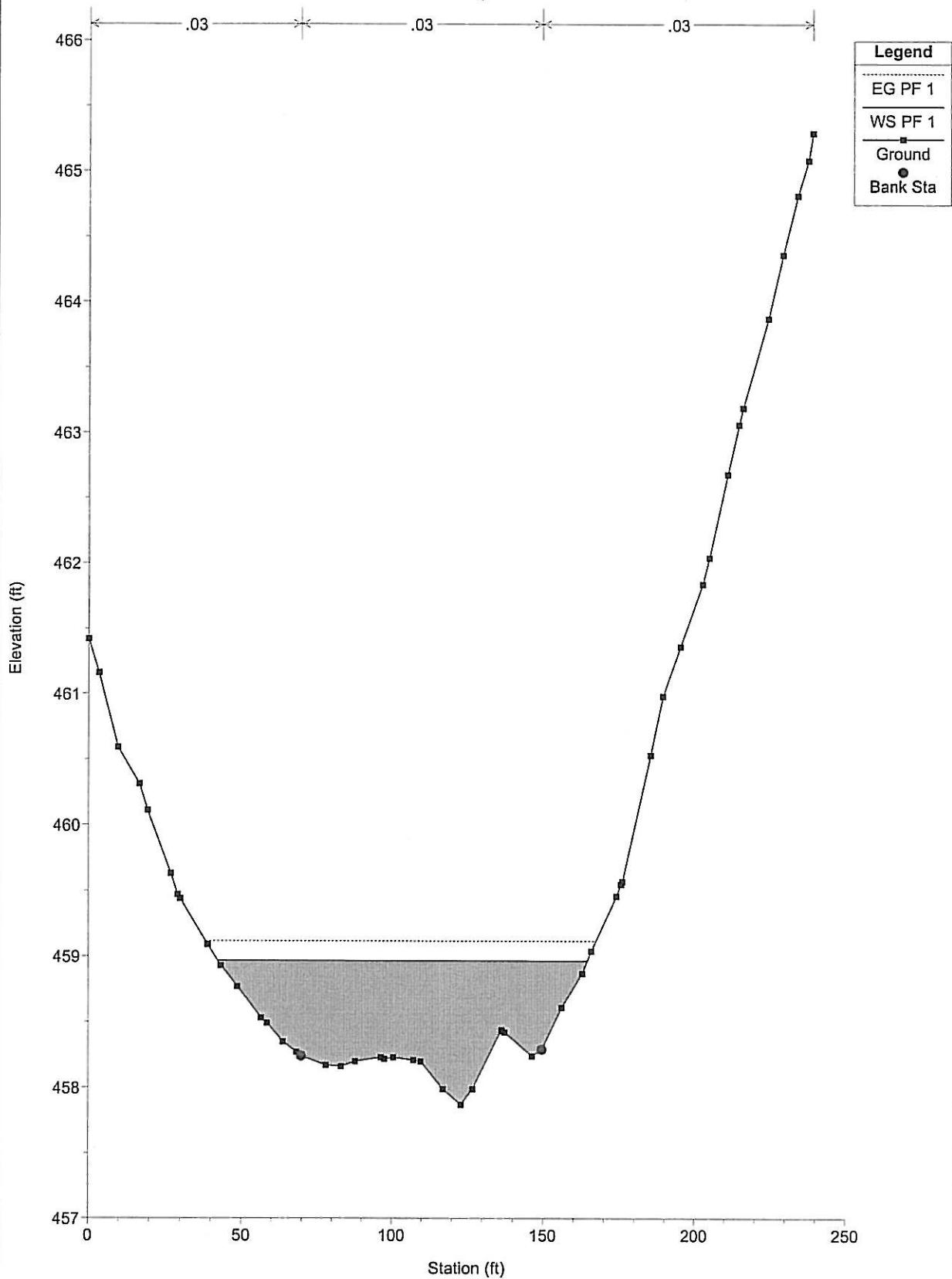
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## EXISTING 100YR INUNDATION YORK DR

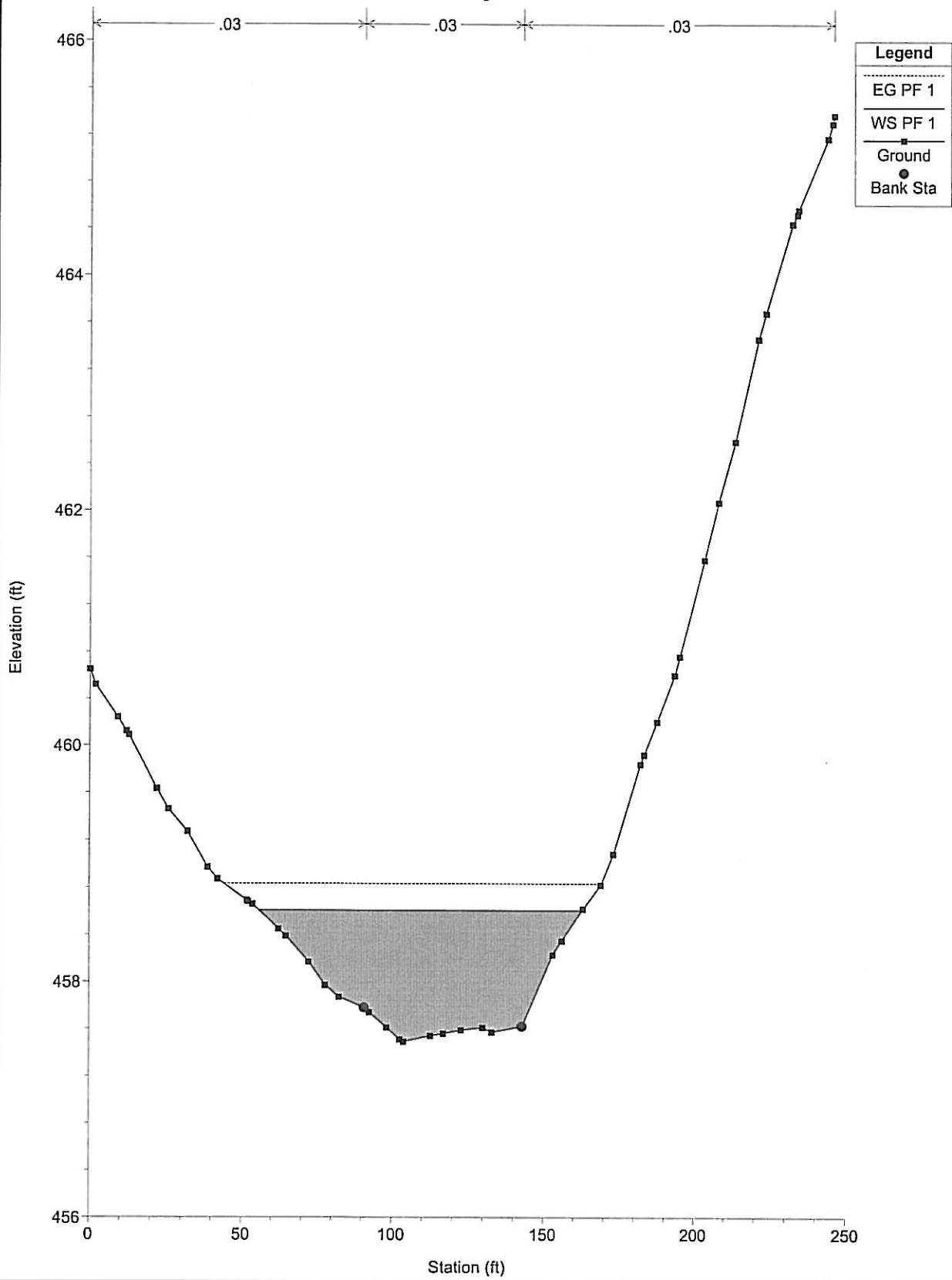
Plan: EXINUNDATION 3/21/2008

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EXISTING 100YR INUNDATION YORK DR Plan: EXINUNDATION 3/21/2008

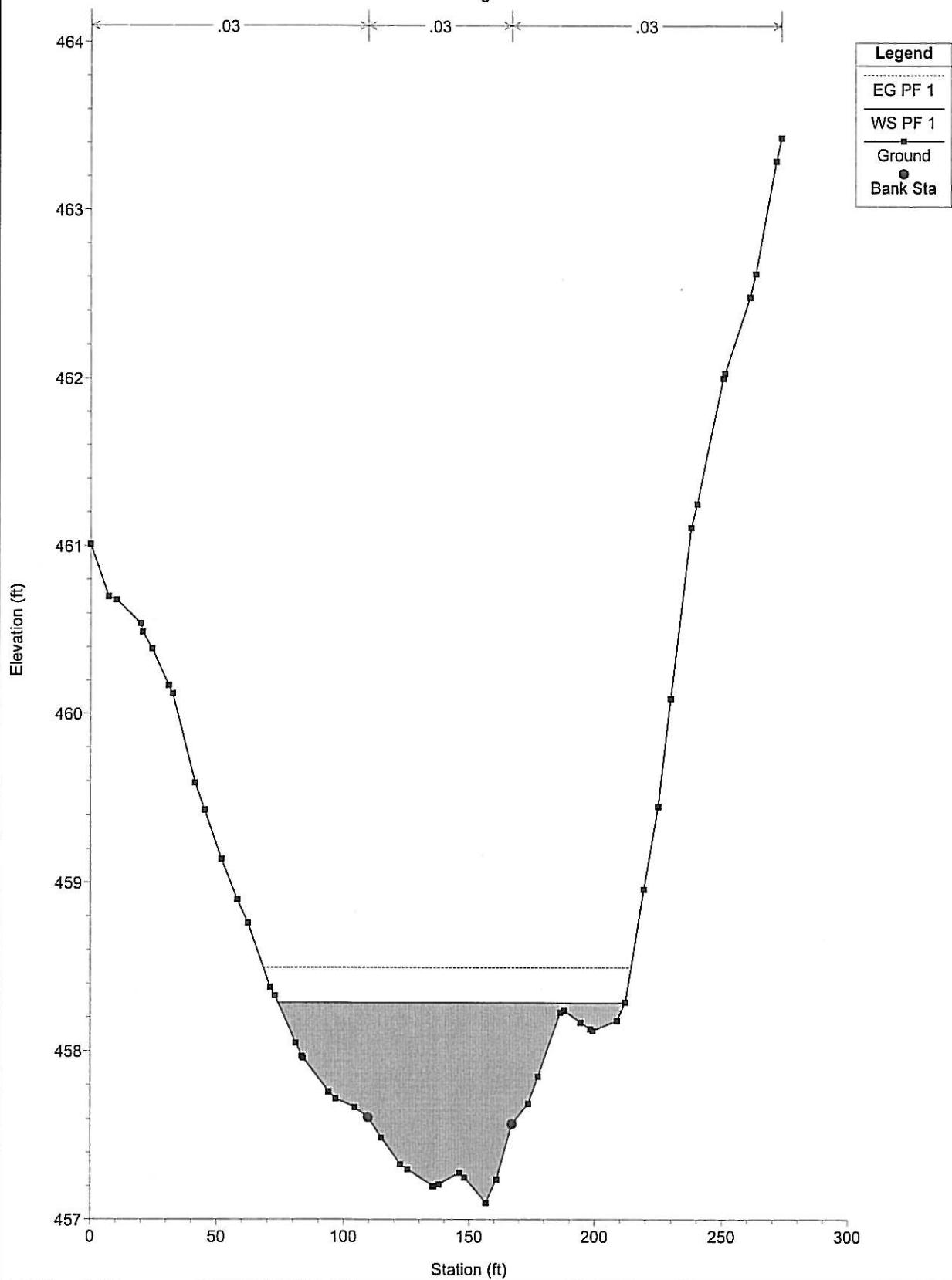
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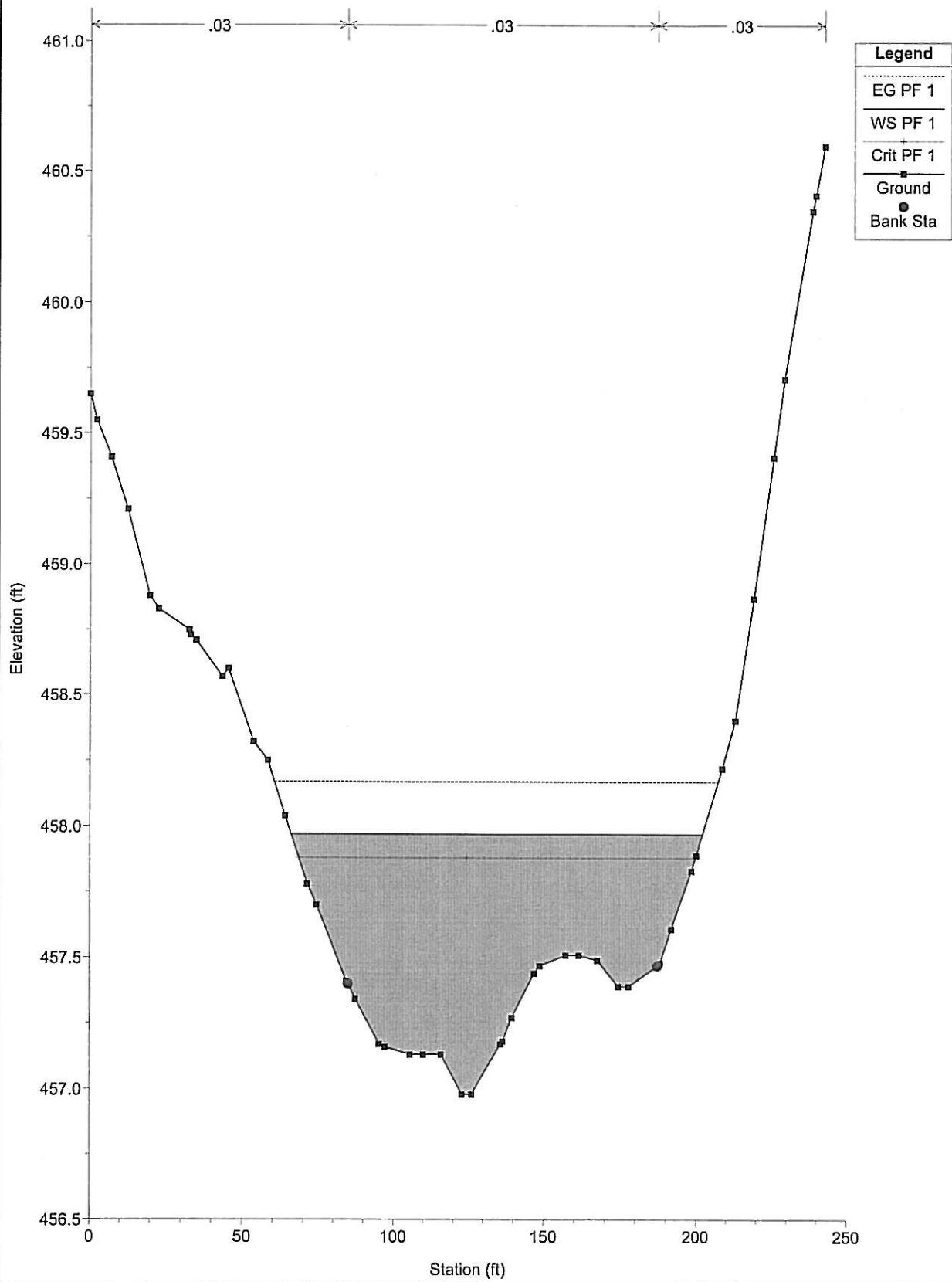
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Plan: EXINUNDATION 3/21/2008

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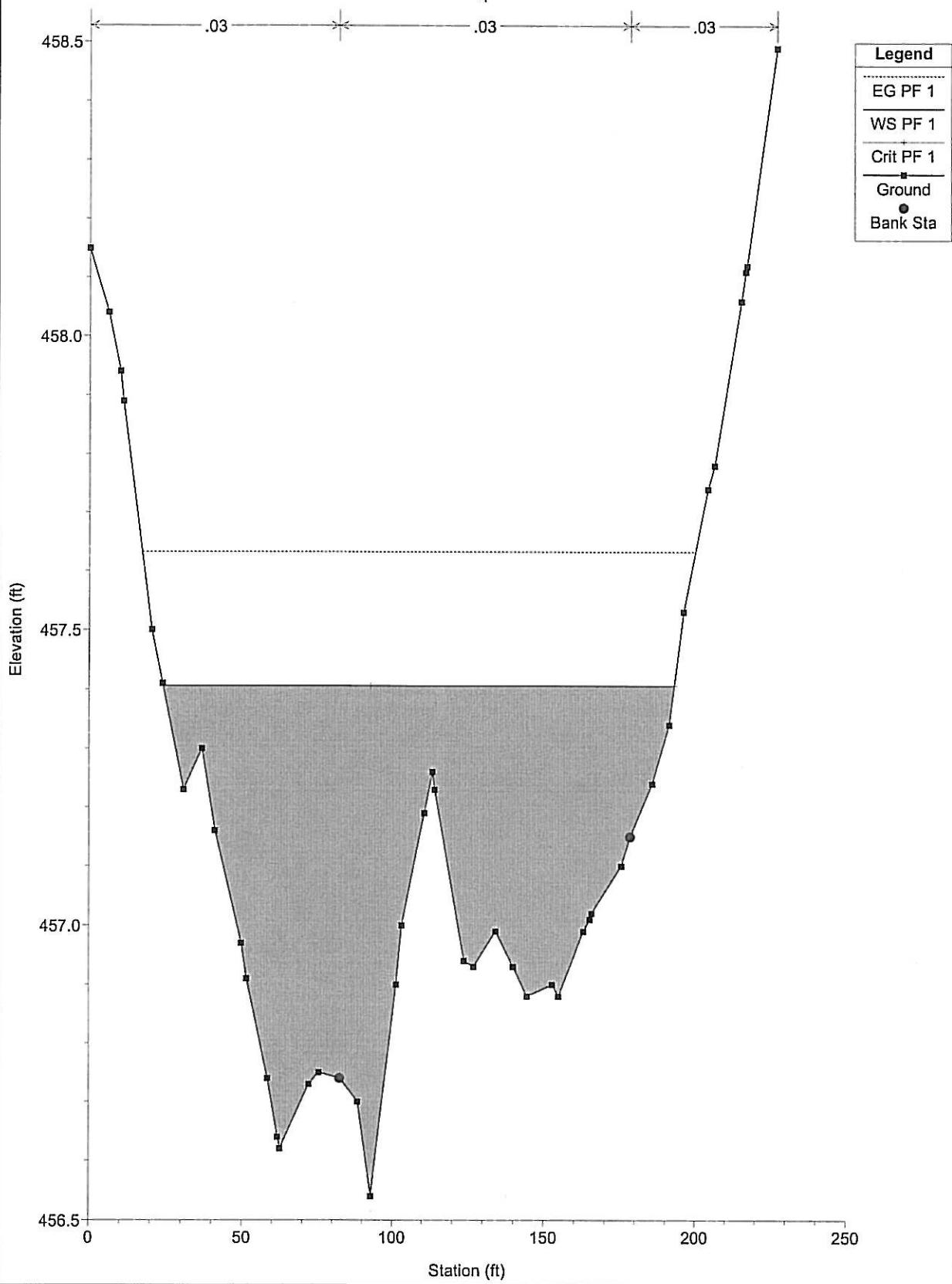
EXISTING 100YR INUNDATION YORK DR Plan: EXINUNDATION 3/21/2008



## EXISTING 100YR INUNDATION YORK DR

Plan: EXINUNDATION 3/21/2008

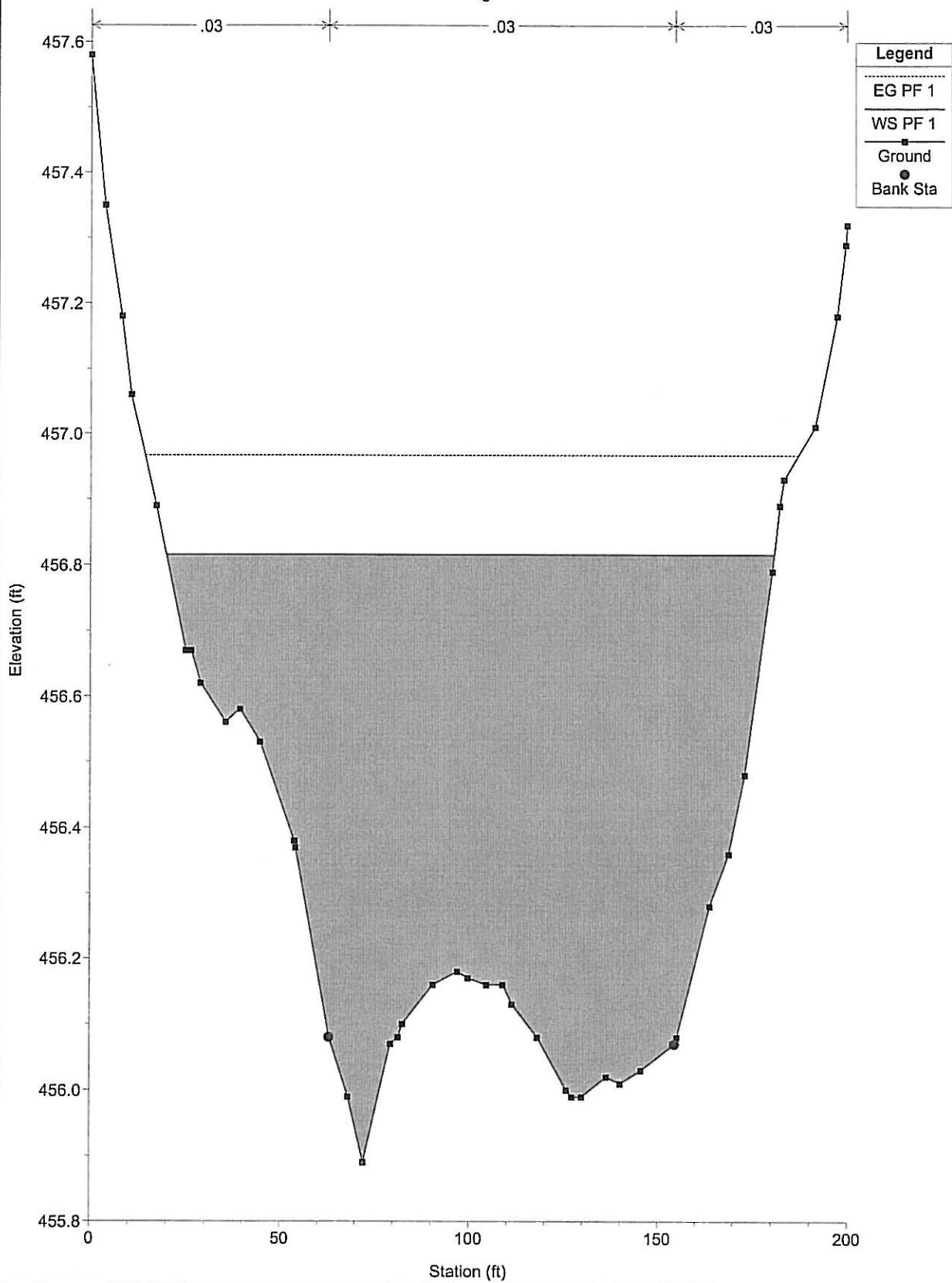
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## EXISTING 100YR INUNDATION YORK DR

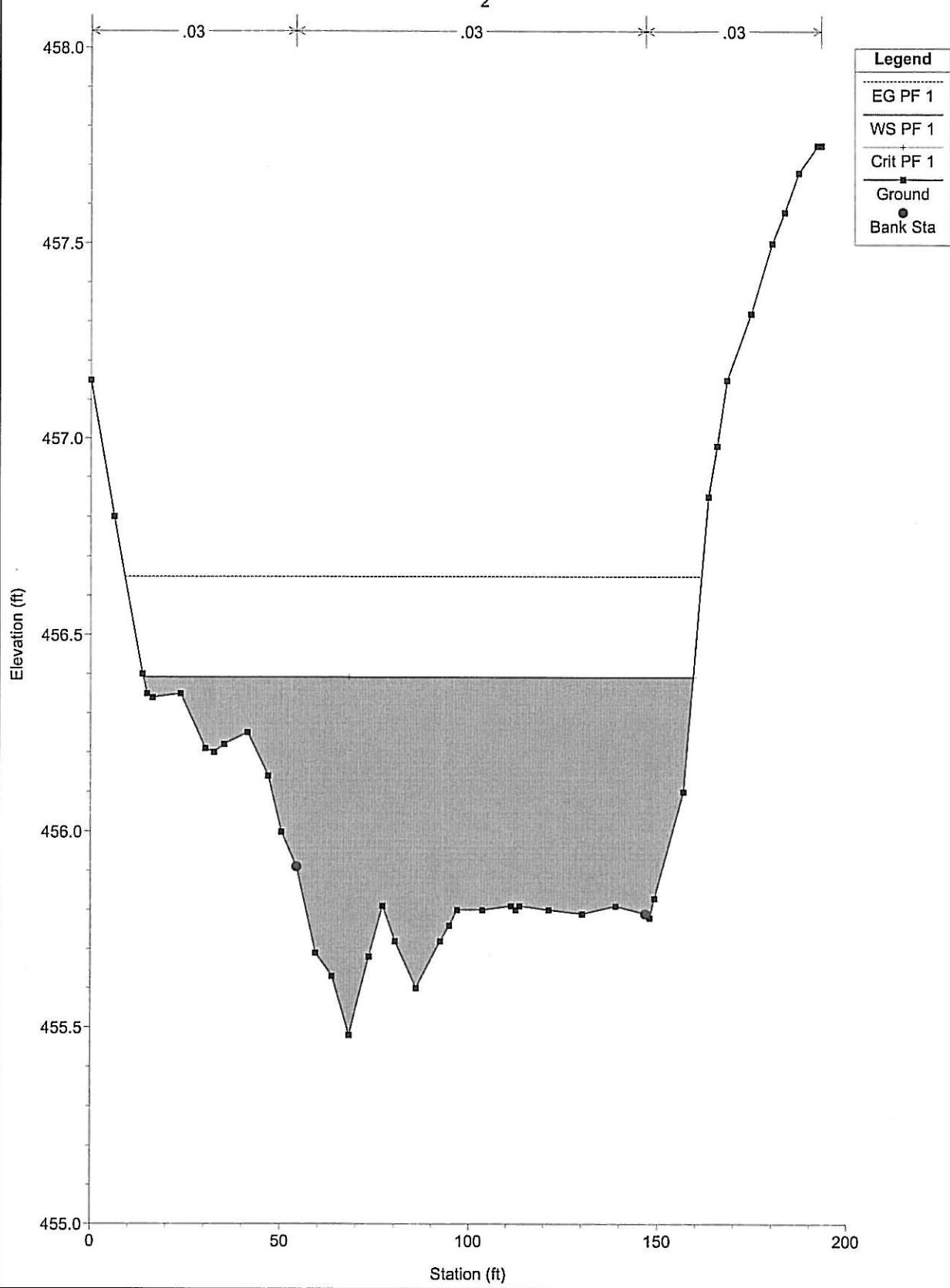
Plan: EXINUNDATION 3/21/2008

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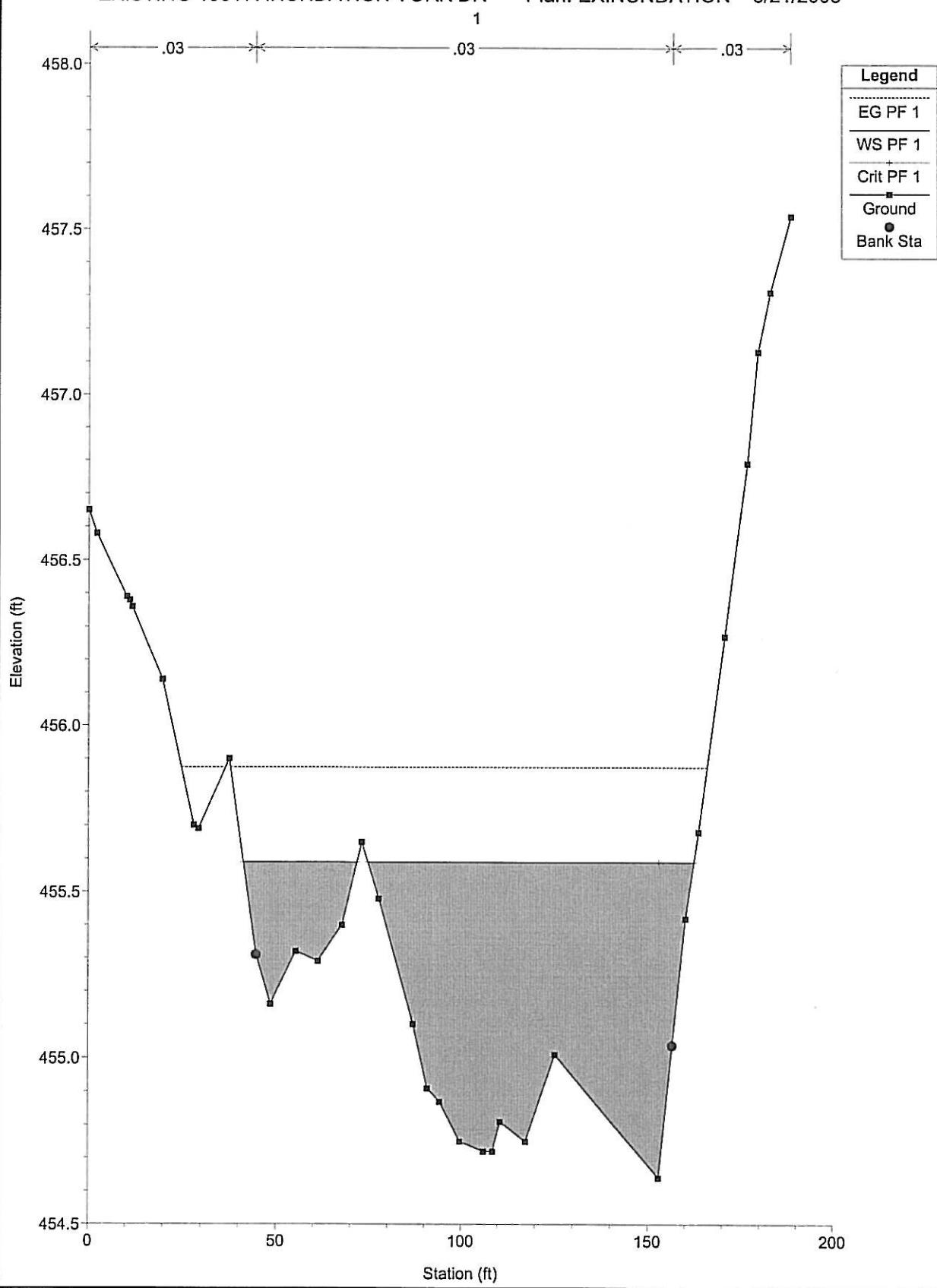


EXISTING 100YR INUNDATION YORK DR Plan: EXINUNDATION 3/21/2008

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EXISTING 100YR INUNDATION YORK DR Plan: EXINUNDATION 3/21/2008



## II. CALCULATIONS

### C. DEVELOPED 100 YEAR FLOOD INUNDATION (HEC-RAS)

## HEC-RAS Plan: DEVINUN River: 1 Reach: 1 Profile: PF 1

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chnl
1	12	PF 1	235.50	459.39	460.92	461.15	0.005397	4.39	68.33	87.92	0.67	
1	11	PF 1	235.50	459.48	460.55	460.82	0.010436	4.65	62.49	114.95	0.87	
1	10	PF 1	235.50	458.45	459.63	459.79	0.004671	3.43	77.33	105.14	0.60	
1	9	PF 1	235.50	458.43	459.36	459.68	0.012010	4.69	55.53	94.47	0.92	
1	8	PF 1	235.50	457.87	458.94	459.14	0.007727	3.63	67.26	97.60	0.73	
1	7	PF 1	277.60	457.49	458.61	458.84	0.006361	4.03	76.86	95.12	0.70	
1	6	PF 1	277.60	457.10	458.29	458.51	0.006695	4.02	79.46	122.75	0.71	
1	5	PF 1	277.60	456.98	457.97	457.88	0.009001	3.66	80.03	136.12	0.78	
1	4	PF 1	277.60	456.54	457.41	457.41	0.016935	3.85	73.36	168.85	1.00	
1	3	PF 1	277.60	455.89	456.82	456.97	0.006530	3.30	93.53	160.96	0.67	
1	2	PF 1	277.60	455.48	456.39	456.39	0.012808	4.19	71.72	145.38	0.92	
1	1	PF 1	277.60	454.64	455.59	455.87	0.015528	4.30	65.41	118.09	0.99	

DEVBRNMOD3B.rep

HEC-RAS Version 3.1.3 May 2005  
U.S. Army Corp of Engineers  
Hydrologic Engineering Center  
609 Second Street  
Davis, California

X	X	XXXXXX	XXXX	XXXX	XX	XXXX
X	X	X	X X	X X	X X	X
X	X	X	X	X X	X X	X
XXXXXX	XXXX	X	XXX	XXXX	XXXXXX	XXXX
X	X	X	X	X X	X X	X
X	X	X	X X	X X	X X	X
X	X	XXXXXX	XXXX	X X	X X	XXXXX

PROJECT DATA

Project Title: DEVELOPED 100-YRINUNDATION YORK DR

Project File : DEVBRNMOD3B.prj

Run Date and Time: 3/21/2008 1:44:16 PM

Project in English units

PLAN DATA

Plan Title: DEVINUNDATION

Plan File : k:\Land Projects 3\757-1019-400\DEVBRNMOD3B.p05

Geometry Title: Imported Geom 02

Geometry File : k:\Land Projects 3\757-1019-400\DEVBRNMOD3B.g02

Flow Title : Imported Flow 02

Flow File : k:\Land Projects 3\757-1019-400\DEVBRNMOD3B.f02

Plan Summary Information:

Number of:	Cross Sections	= 12	Multiple Openings	= 0
	Culverts	= 0	Inline Structures	= 0
	Bridges	= 0	Lateral Structures	= 0

Computational Information

Water surface calculation tolerance = 0.01

Critical depth calculation tolerance = 0.01

Maximum number of iterations = 20

Maximum difference tolerance = 0.3

Flow tolerance factor = 0.001

Computation Options

Critical depth computed only where necessary

Conveyance Calculation Method: At breaks in n values only

Friction Slope Method: Average Conveyance

Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: Imported Flow 02

DEVBRNMOD3B.rep  
Flow File : k:\Land Projects 3\757-1019-400\DEVBRNMOD3B.f02

Flow Data (cfs)

River	Reach	RS	PF	1
1	1	12	235.5	
1		7	277.6	

Boundary Conditions

River	Reach	Profile	Upstream
Downstream			
1	1	PF 1	Critical

GEOMETRY DATA

Geometry Title: Imported Geom 02  
Geometry File : k:\Land Projects 3\757-1019-400\DEVBRNMOD3B.g02

CROSS SECTION

RIVER: 1  
REACH: 1 RS: 12

INPUT

Description: 11

Station	Elevation	Data	num=	27					
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	462.24	5.9	462.04	8.12	461.96	18.44	461.81	21.64	461.72
30.97	461.45	35.16	461.27	43.5	461.03	48.69	460.81	56.04	460.56
62.21	460.29	68.57	460.03	75.73	459.84	81.1	459.67	89.26	459.46
93.64	459.39	102.78	459.81	106.17	459.95	110.21	460.122	116.3	460.38
118.7	460.48	129.83	460.82	131.24	460.84	143.35	461.19	143.77	461.2
144.13	461.23	144.24	461.23						

Manning's	n	Values	num=	3		
Sta	n	Val	Sta	n Val	Sta	n Val
0	.03	75.73	.03	102.78	.03	

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	75.73	102.78		47.56	45.42	43.27	.1		.3

CROSS SECTION

RIVER: 1  
REACH: 1 RS: 11

INPUT

Description: 10

Station	Elevation	Data	num=	38					
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	462.46	.51	462.45	11.06	462.13	13.02	462.1	24.29	462.12

DEVBRNMOD3B.rep

25.54	462.14	37.51	461.72	38.06	461.66	47.71	461.1	50.58	460.92
50.74	460.91	63.09	460.53	63.96	460.51	75.43	459.9	75.61	459.89
77.19	459.85	88.13	459.48	90.41	459.48	100.65	459.62	103.64	459.67
113.17	459.81	116.86	459.87	125.68	459.99	130.09	459.99	138.2	460.13
143.31	460.07	150.72	460.13	156.54	460.31	163.34	460.34	169.76	460.5
175.76	460.48	182.98	460.76	188.27	460.84	196.21	460.9	200.79	460.97
209.43	461.95	213.31	462.27	214.21	462.54				

Manning's n Values      num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	75.43	.03	116.86	.03

Bank Sta: Left      Right      Lengths: Left Channel      Right      Coeff Contr.      Expan.

Sta	Left	Right	Lengths	Left	Channel	Right	Coeff	Contr.	Expan.
	75.43	116.86		45.37	56.91	68.44	.1	.3	

#### CROSS SECTION

RIVER: 1  
REACH: 1      RS: 10

INPUT  
Description: 9

Station Elevation Data      num= 40

Sta	Elev								
0	465	26.86	465	39.96	459.8	41.12	459.8	42.41	459.79
45.62	459.61	55.44	459.48	55.69	459.47	56.54	459.43	65.76	458.91
68.45	458.85	75.83	458.79	81.49	458.57	85.9	458.49	94.52	458.46
95.97	458.45	100.94	458.51	106.05	458.55	107.55	458.56	116.12	458.63
120.57	458.68	126.19	458.77	133.6	458.94	136.26	459.04	145.33	459.5
146.33	459.54	146.63	459.56	156.4	459.74	159.65	460.09	166.48	460.52
172.68	460.86	176.55	461.38	185.71	462.14	186.62	462.24	189.72	462.49
196.69	462.98	198.74	463.14	199.3	463.27	201.48	463.49	203.02	463.45

Manning's n Values      num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	75.83	.03	133.6	.03

Bank Sta: Left      Right      Lengths: Left Channel      Right      Coeff Contr.      Expan.

Sta	Left	Right	Lengths	Left	Channel	Right	Coeff	Contr.	Expan.
	75.83	133.6		13.52	14.3	15.48	.1	.3	

#### CROSS SECTION

RIVER: 1  
REACH: 1      RS: 9

INPUT  
Description: 8

Station Elevation Data      num= 39

Sta	Elev								
0	465	31.53	465	44.17	459.41	45.44	459.38	53.99	459.24
55.02	459.22	55.35	459.22	64.95	458.9	68.49	458.85	74.88	458.61
81.62	458.44	84.81	458.43	94.68	458.44	94.74	458.44	94.76	458.44
104.67	458.5	107.89	458.55	114.6	458.65	121.03	458.7	124.53	458.78
134.16	459.06	134.46	459.07	135.36	459.12	144.39	459.5	147.3	459.63
154.32	460.15	160.44	460.4	164.25	460.46	173.57	460.9	174.17	460.94
176.05	461.07	184.1	461.68	186.71	461.86	194.03	462.46	199.84	462.9
201.93	463.32	204.29	463.86	205.82	464.02	206.89	463.99		

Manning's n Values      num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	68.49	.03	124.53	.03

## DEVBRNMOD3B.rep

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.  
 68.49 124.53 43.1 44.1 45.1 .1 .3

## CROSS SECTION

RIVER: 1

REACH: 1

RS: 8

## INPUT

Description: 7

Station Elevation Data		num= 40									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	465	54.48	465	67.96	458.27	69	458.25	69.87	458.24		
78.03	458.17	83.16	458.16	87.79	458.2	96.45	458.23	97.55	458.22		
100.6	458.23	107.32	458.21	109.74	458.2	117.08	457.99	123.03	457.87		
126.85	457.99	136.32	458.44	136.61	458.43	137.4	458.42	146.37	458.24		
149.61	458.29	156.14	458.61	162.9	458.87	165.9	459.04	174.2	459.46		
175.66	459.55	176.19	459.57	185.43	460.53	189.48	460.98	195.19	461.36		
202.78	461.84	204.96	462.04	210.99	462.68	214.72	463.06	216.07	463.19		
224.48	463.87	229.36	464.36	234.25	464.81	237.8	465.08	239.25	465.29		

Manning's n Values

Sta n Val		num= 3									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	69.87	.03	149.61	.03						

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.  
 69.87 149.61 45.86 43.79 41.71 .1 .3

## CROSS SECTION

RIVER: 1

REACH: 1

RS: 7

## INPUT

Description: 6

Station Elevation Data		num= 41									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	465	54.92	465	68.55	458.29	69.63	458.25	72.46	458.17		
77.92	457.97	82.54	457.87	90.94	457.78	92.62	457.74	98.36	457.61		
102.7	457.51	103.96	457.49	112.78	457.54	116.98	457.56	122.86	457.59		
130.01	457.61	132.93	457.57	142.97	457.62	143.01	457.62	143.03	457.62		
153.09	458.23	156.05	458.35	163.17	458.62	169.07	458.82	173.25	459.08		
182.09	459.84	183.33	459.92	187.57	460.2	193.41	460.6	195.11	460.76		
203.49	461.58	208.14	462.07	213.57	462.59	221.16	463.46	223.65	463.68		
232.18	464.44	233.73	464.52	234.18	464.56	243.81	465.17	245.29	465.3		
245.87	465.37										

Manning's n Values

Sta n Val		num= 3									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	90.94	.03	142.97	.03						

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.  
 90.94 142.97 52.23 50.04 47.84 .1 .3

## CROSS SECTION

RIVER: 1

REACH: 1

RS: 6

## DEVBRNMOD3B.rep

## INPUT

Description: 5

Station	Elevation	Data	num=	40			
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	465	75.5	465	90.23	457.84	91.3	457.81
96.84	457.72	104.41	457.67	109.65	457.61	114.86	457.49
125.31	457.3	135.28	457.2	135.76	457.2	137.88	457.21
148.1	457.25	156.67	457.1	160.92	457.24	167.12	457.57
177.57	457.85	186.55	458.23	188.02	458.24	194.54	458.17
199.36	458.12	208.93	458.18	212.18	458.29	219.38	458.96
229.83	460.09	237.81	461.11	240.28	461.25	250.63	462
251.31	462.03	261.19	462.48	263.44	462.62	271.64	463.29
							273.71
							463.43

Manning's n Values

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	109.65	.03	167.12	.03

Bank Sta: Left Right

Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	39.17	42.84	46.5	.1	.3	

## CROSS SECTION

RIVER: 1

REACH: 1

RS: 5

## INPUT

Description:

Station	Elevation	Data	num=	38			
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	465	49.86	465	65.31	458	71.39	457.78
84.26	457.41	84.86	457.4	87.27	457.34	95.19	457.17
105.51	457.13	110.01	457.13	115.84	457.13	122.88	456.98
135.76	457.17	136.5	457.18	139.52	457.27	146.83	457.44
157.16	457.51	161.51	457.51	167.49	457.49	174.38	457.39
187.25	457.47	188.15	457.48	191.78	457.61	198.48	457.83
208.81	458.22	213	458.4	219.14	458.87	225.87	459.41
238.75	460.35	239.79	460.41	242.86	460.6		229.46
							459.71

Manning's n Values

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	84.86	.03	187.25	.03

Bank Sta: Left Right

Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	44.27	44.2	44.1	.1	.3	

## CROSS SECTION

RIVER: 1

REACH: 1

RS: 4

## INPUT

Description: 4

Station	Elevation	Data	num=	45			
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	458.15	6.28	458.04	10.23	457.94	11.2	457.89
24.07	457.41	30.89	457.23	36.95	457.3	41.21	457.16
51.54	456.91	58.53	456.74	61.87	456.64	62.7	456.62
75.57	456.75	82.53	456.74	88.44	456.7	92.86	456.54
103.19	457	110.79	457.19	113.52	457.26	114.19	457.23
127.06	456.93	134.18	456.99	139.94	456.93	144.51	456.88
154.83	456.88	163.05	456.99	165.16	457.01	165.69	457.02
							175.49
							457.1

178.56 457.15 185.82 457.24 191.43 457.34 196.15 457.53 204.31 457.74  
 206.48 457.78 215.31 458.06 216.81 458.11 217.18 458.12 227.14 458.49

Manning's n Values num= 3  
 Sta n Val Sta n Val Sta n Val  
 0 .03 82.53 .03 178.56 .03

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.  
 82.53 178.56 33.5 46.44 59.37 .1 .3

#### CROSS SECTION

RIVER: 1

REACH: 1 RS: 3

#### INPUT

Description: 3

Station	Elevation	Data	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	457.58	3.71	457.35	8.14	457.18	10.66	457.06	17.3	456.89	
25.05	456.67	26.47	456.67	28.95	456.62	35.63	456.56	39.44	456.58	
44.79	456.53	53.83	456.38	53.96	456.38	54.19	456.37	63.12	456.08	
68.22	455.99	72.29	455.89	79.42	456.07	81.45	456.08	82.61	456.1	
90.61	456.16	96.99	456.18	99.78	456.17	104.66	456.16	108.94	456.16	
111.38	456.13	118.11	456.08	125.77	456	127.27	455.99	129.9	455.99	
136.43	456.02	140.16	456.01	145.6	456.03	154.55	456.07	154.76	456.07	
155.13	456.08	163.93	456.28	168.94	456.36	173.09	456.48	180.37	456.79	
182.25	456.89	183.33	456.93	191.42	457.01	197.22	457.18	199.47	457.29	
199.89	457.32									

Manning's n Values num= 3  
 Sta n Val Sta n Val Sta n Val  
 0 .03 63.12 .03 154.55 .03

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.  
 63.12 154.55 25.98 34.74 44.5 .1 .3

#### CROSS SECTION

RIVER: 1

REACH: 1 RS: 2

#### INPUT

Description: 2

Station	Elevation	Data	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	457.15	6.24	456.8	13.83	456.4	15.1	456.35	16.54	456.34	
23.95	456.35	30.46	456.21	32.81	456.2	35.5	456.22	41.67	456.25	
47.08	456.14	50.53	455.999	54.46	455.91	59.369	455.69	63.71	455.63	
68.24	455.48	73.41	455.68	77.1	455.81	80.34	455.72	85.96	455.6	
92.37	455.72	94.82	455.76	96.96	455.8	103.67	455.8	111.33	455.81	
112.53	455.8	113.59	455.81	121.39	455.8	130.21	455.79	130.25	455.79	
130.29	455.79	139.11	455.81	146.84	455.79	147.96	455.78	149.24	455.83	
156.82	456.1	163.47	456.85	165.68	456.98	168.2	457.15	174.54	457.32	
180.09	457.5	183.39	457.58	187.16	457.68	192.25	457.75	193.19	457.75	

Manning's n Values num= 3  
 Sta n Val Sta n Val Sta n Val  
 0 .03 54.46 .03 146.84 .03

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.  
 Page 6

54.46 146.84 DEVBRNMOD3B.rep  
57.43 54.61 51.79 .1 .3

CROSS SECTION

RIVER: 1

REACH: 1

RS: 1

INPUT

Description: 1

Station	Elevation	Data	num=	34	Station	Elev	Sta	Elev	Sta	Elev	Sta	Elev							
0	456.65	2.25	456.58	10.31	456.39	11.12	456.38	11.8	456.36	19.98	456.14	28.29	455.7	29.49	455.69	37.71	455.9	44.78	455.31
48.66	455.16	55.43	455.32	61.26	455.29	67.83	455.4	73.16	455.65	77.75	455.48	87	455.1	90.89	454.91	94.24	454.87	99.75	454.75
106.17	454.72	108.62	454.72	110.72	454.81	117.48	454.75	125.34	455.01	152.94	454.64	156.62	455.037	160.18	455.42	163.69	455.68	170.67	456.27
176.67	456.79	179.53	457.13	182.86	457.31	188.39	457.54												

Manning's n Values

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	44.78	.03	156.62	.03

Bank Sta:	Left	Right	Coeff	Contr.	Expan.
	44.78	156.62		.1	.3

SUMMARY OF MANNING'S N VALUES

River:1

Reach	River Sta.	n1	n2	n3
1	12	.03	.03	.03
1	11	.03	.03	.03
1	10	.03	.03	.03
1	9	.03	.03	.03
1	8	.03	.03	.03
1	7	.03	.03	.03
1	6	.03	.03	.03
1	5	.03	.03	.03
1	4	.03	.03	.03
1	3	.03	.03	.03
1	2	.03	.03	.03
1	1	.03	.03	.03

SUMMARY OF REACH LENGTHS

River: 1

Reach	River Sta.	Left	Channel	Right
1	12	47.56	45.42	43.27
1	11	45.37	56.91	68.44
1	10	13.52	14.3	15.48
1	9	43.1	44.1	45.1
1	8	45.86	43.79	41.71
1	7	52.23	50.04	47.84

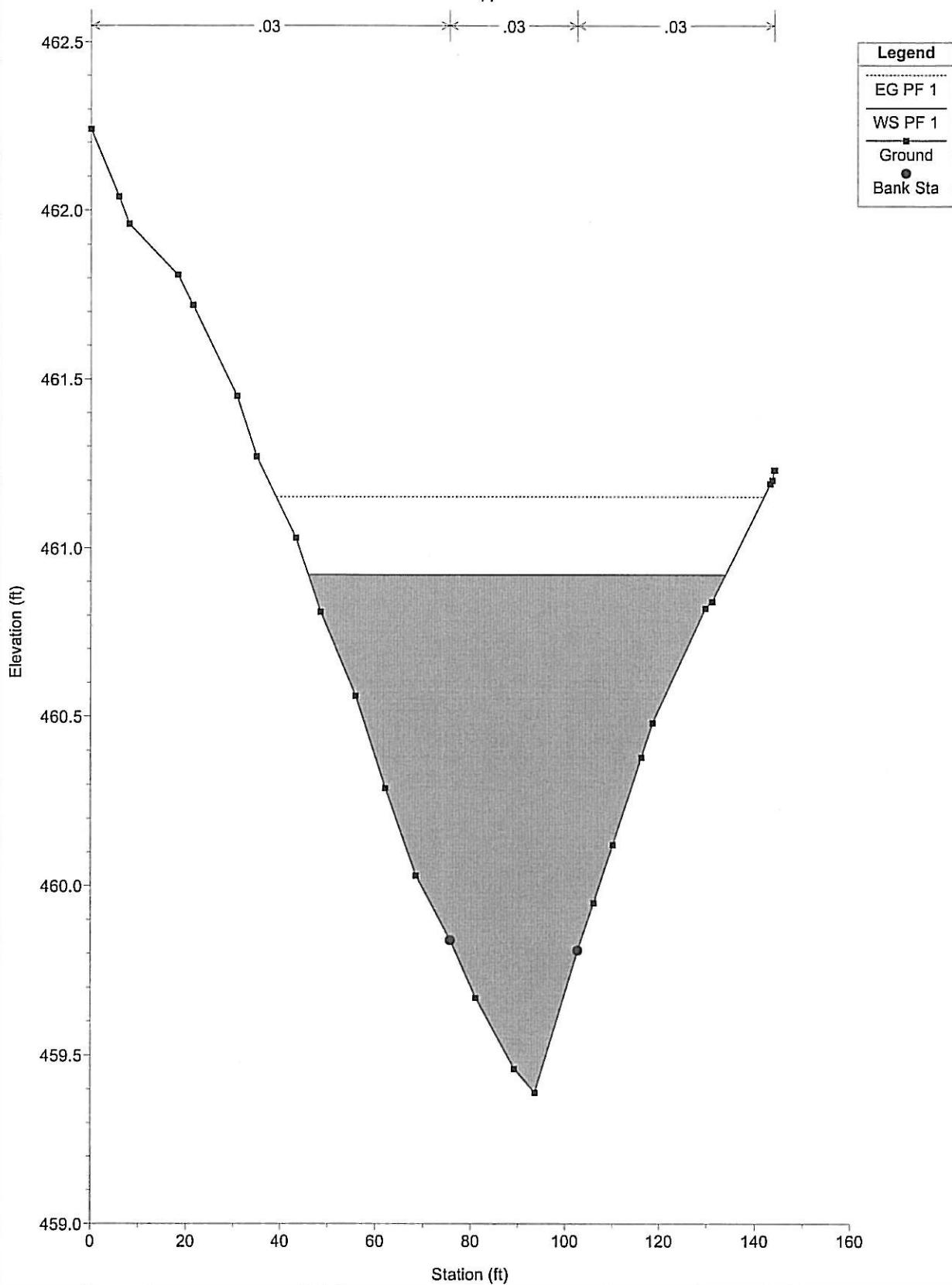
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 1                   5                   44.27           44.2           44.1  
 1                   4                   33.5           46.44           59.37  
 1                   3                   25.98           34.74           44.5  
 1                   2                   57.43           54.61           51.79  
 1                   1

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS  
 River: 1

	Reach	River Sta.	Contr.	Expan.
1		12	.1	.3
1		11	.1	.3
1		10	.1	.3
1		9	.1	.3
1		8	.1	.3
1		7	.1	.3
1		6	.1	.3
1		5	.1	.3
1		4	.1	.3
1		3	.1	.3
1		2	.1	.3
1		1	.1	.3

DEVELOPED 100-YRINUNDATION YORK DR Plan: DEVINUNDATION 3/21/2008

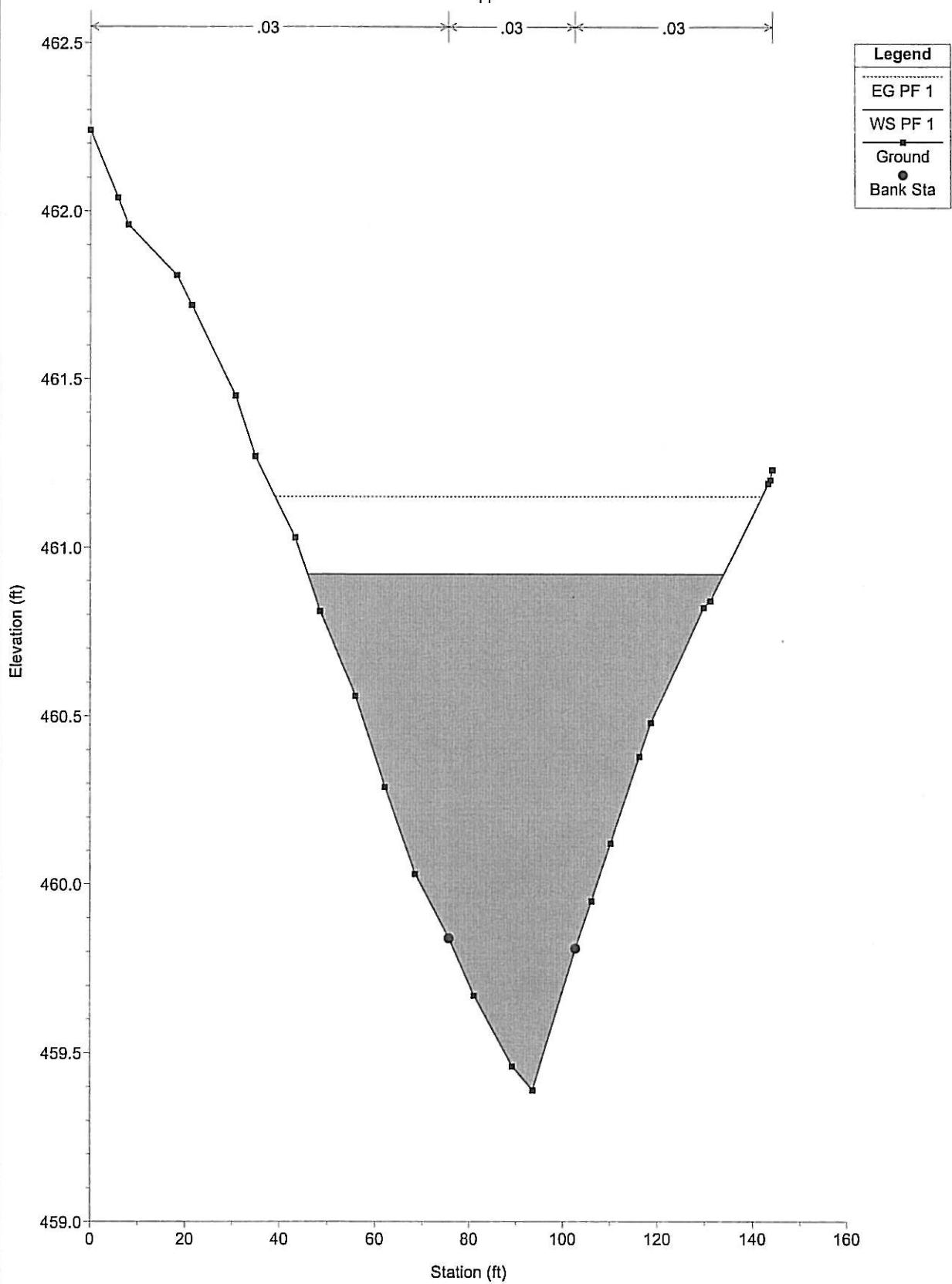
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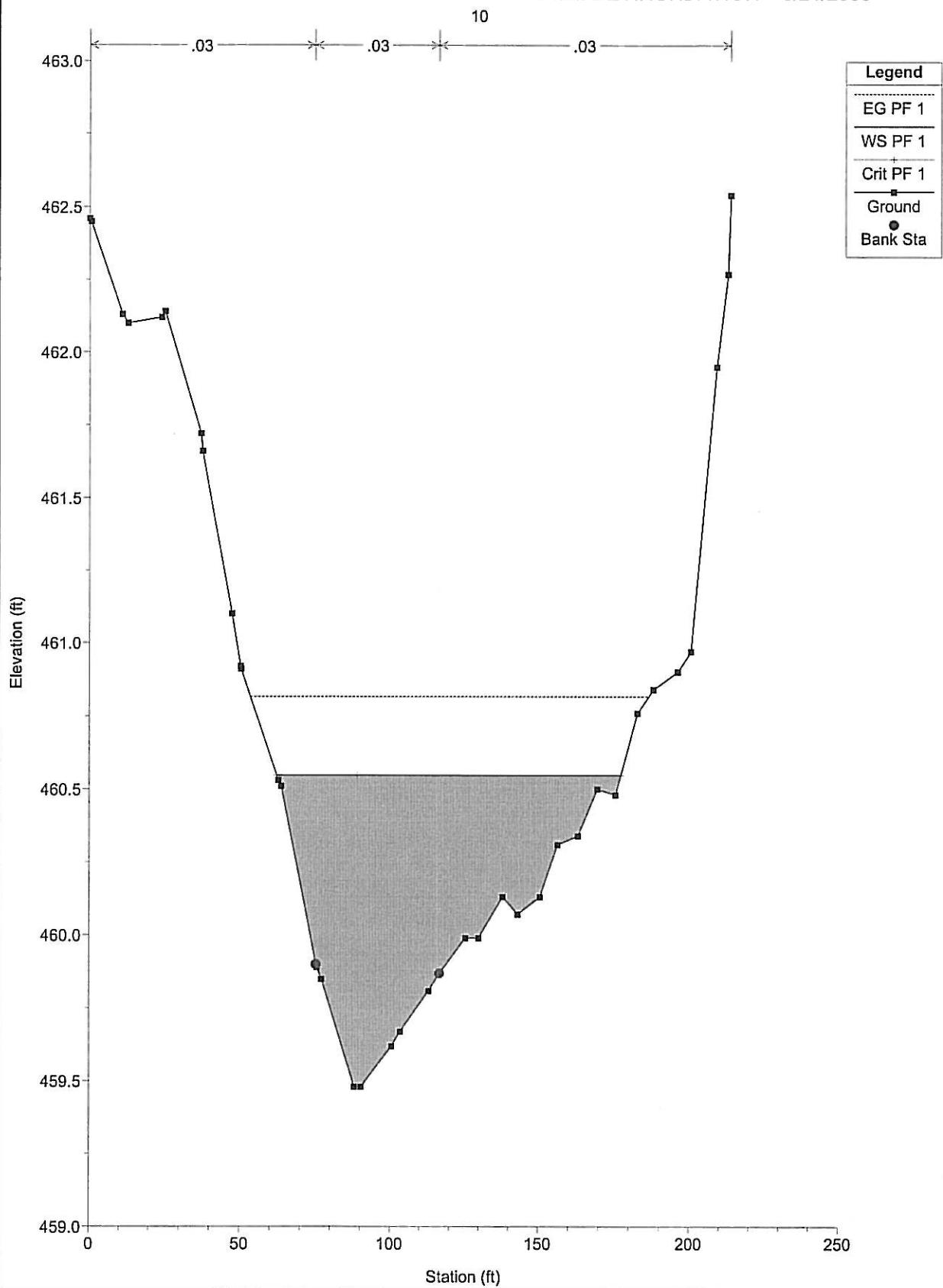
## DEVELOPED 100-YR INUNDATION YORK DR

Plan: DEVINUNDATION 3/21/2008

11



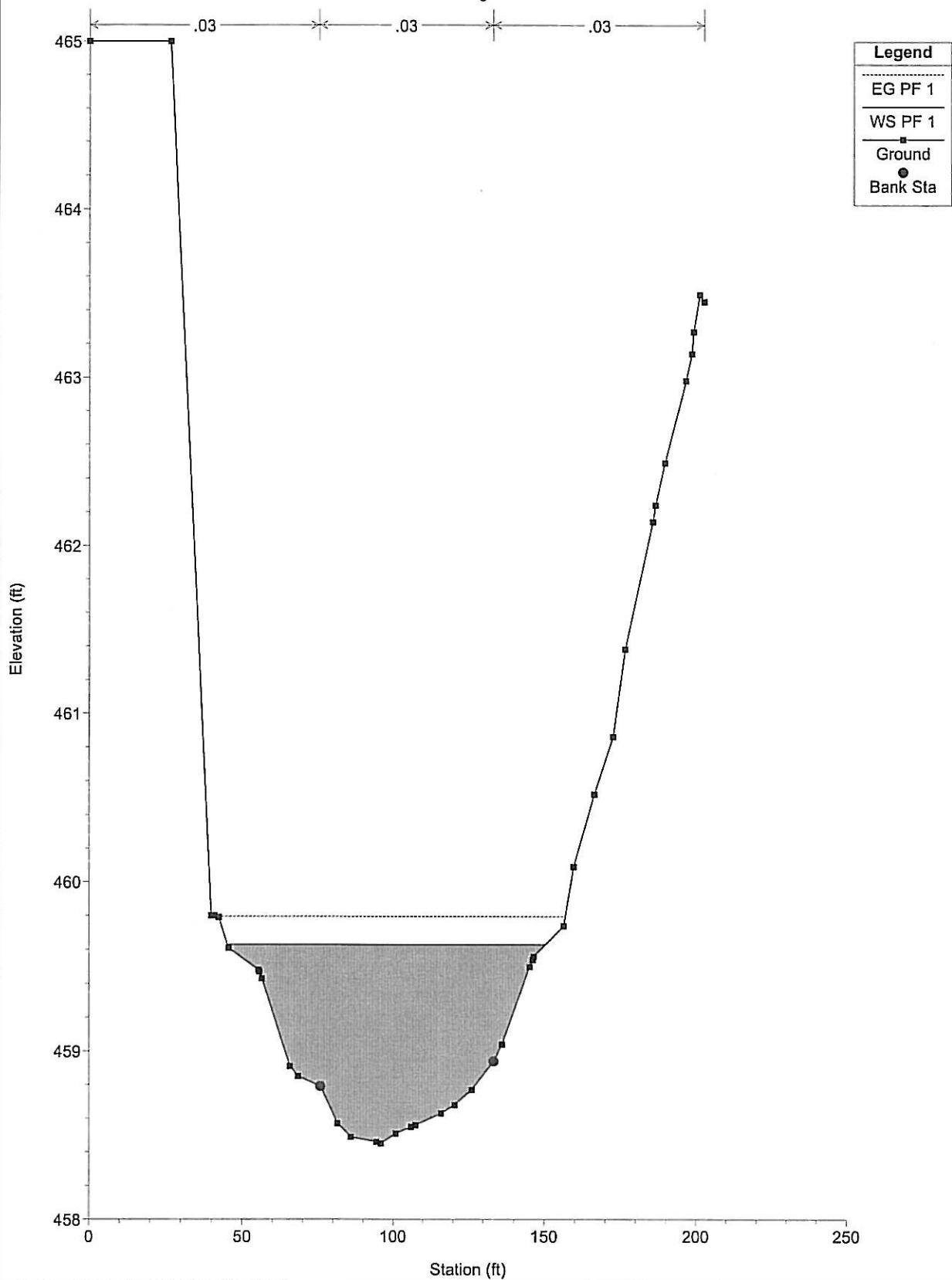
DEVELOPED 100-YRINUNDATION YORK DR Plan: DEVINUNDATION 3/21/2008



DEVELOPED 100-YR INUNDATION YORK DR

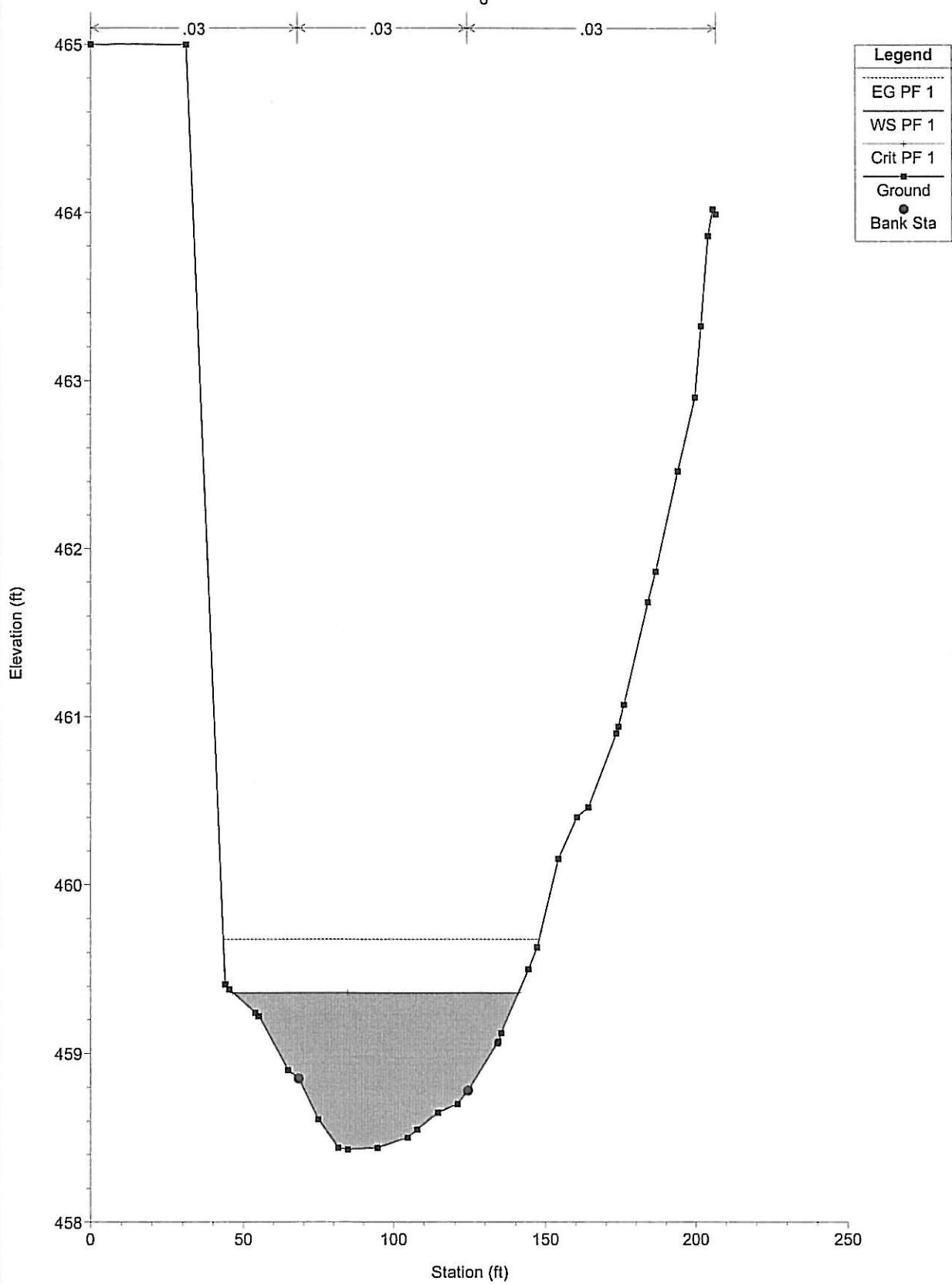
Plan: DEVINUNDATION 3/21/2008

9



DEVELOPED 100-YR INUNDATION YORK DR Plan: DEVINUNDATION 3/21/2008

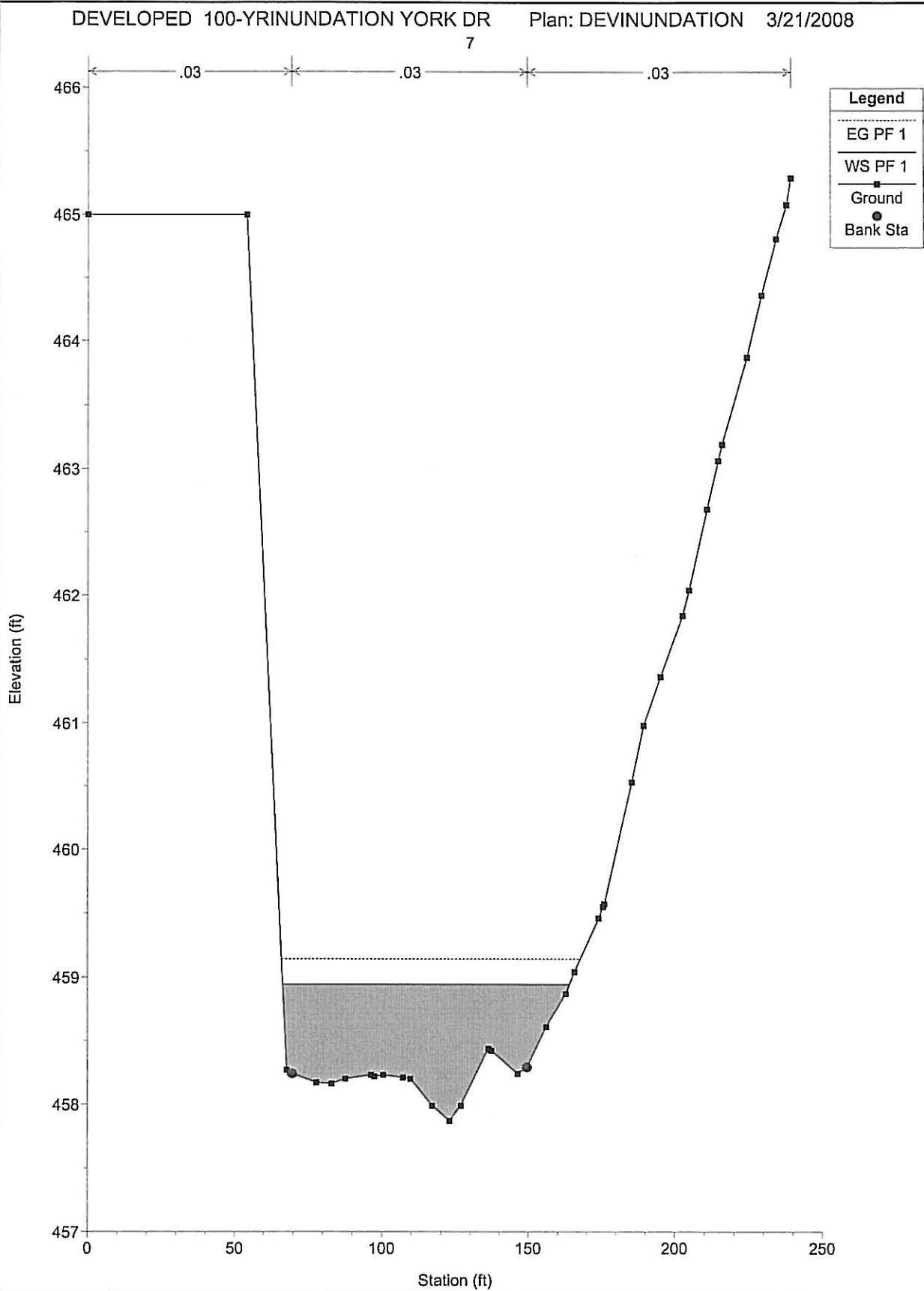
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## DEVELOPED 100-YR INUNDATION YORK DR

Plan: DEINUNDATION 3/21/2008

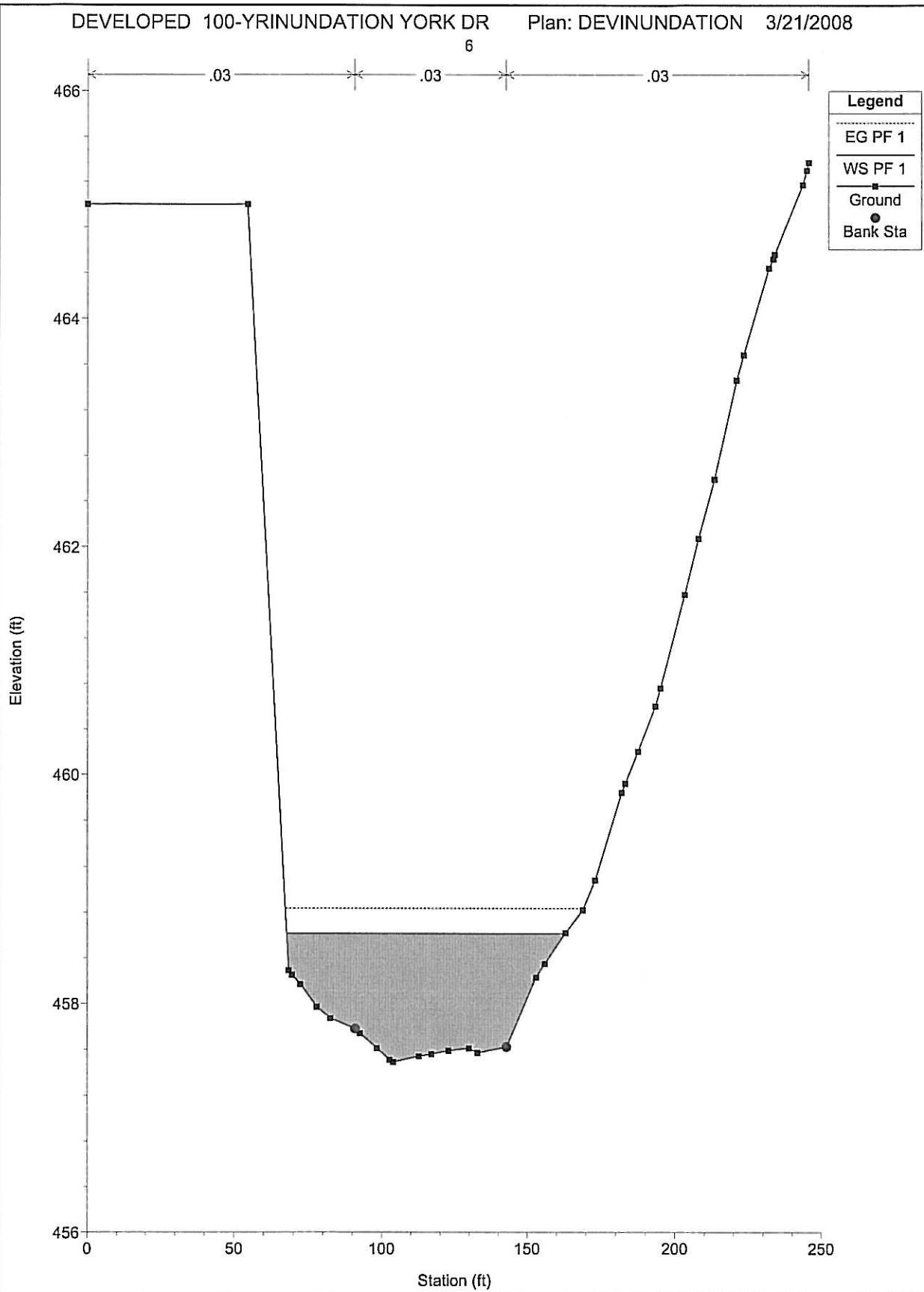
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DEVELOPED 100-YR INUNDATION YORK DR

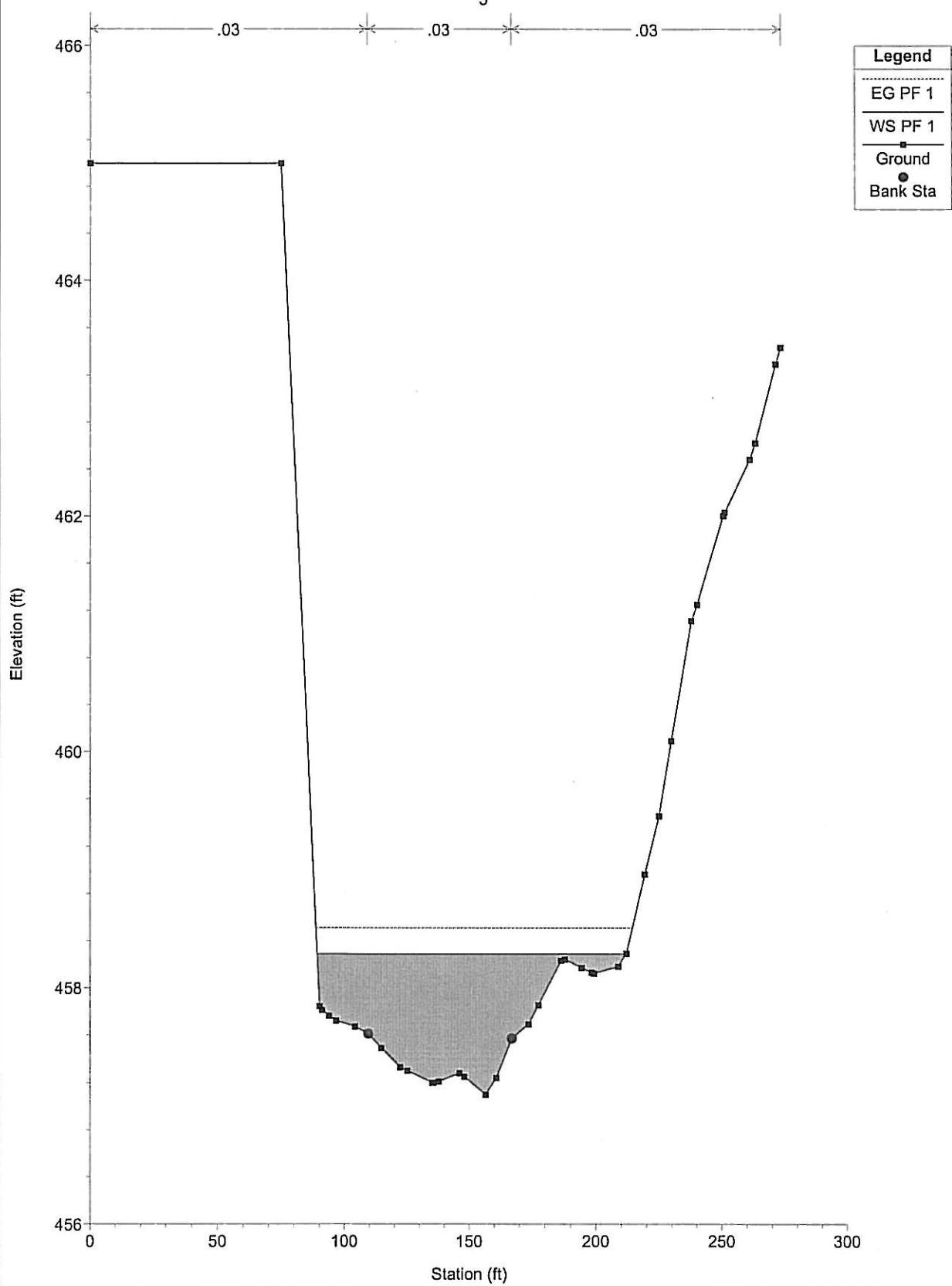
Plan: DEINUNDATION 3/21/2008

6



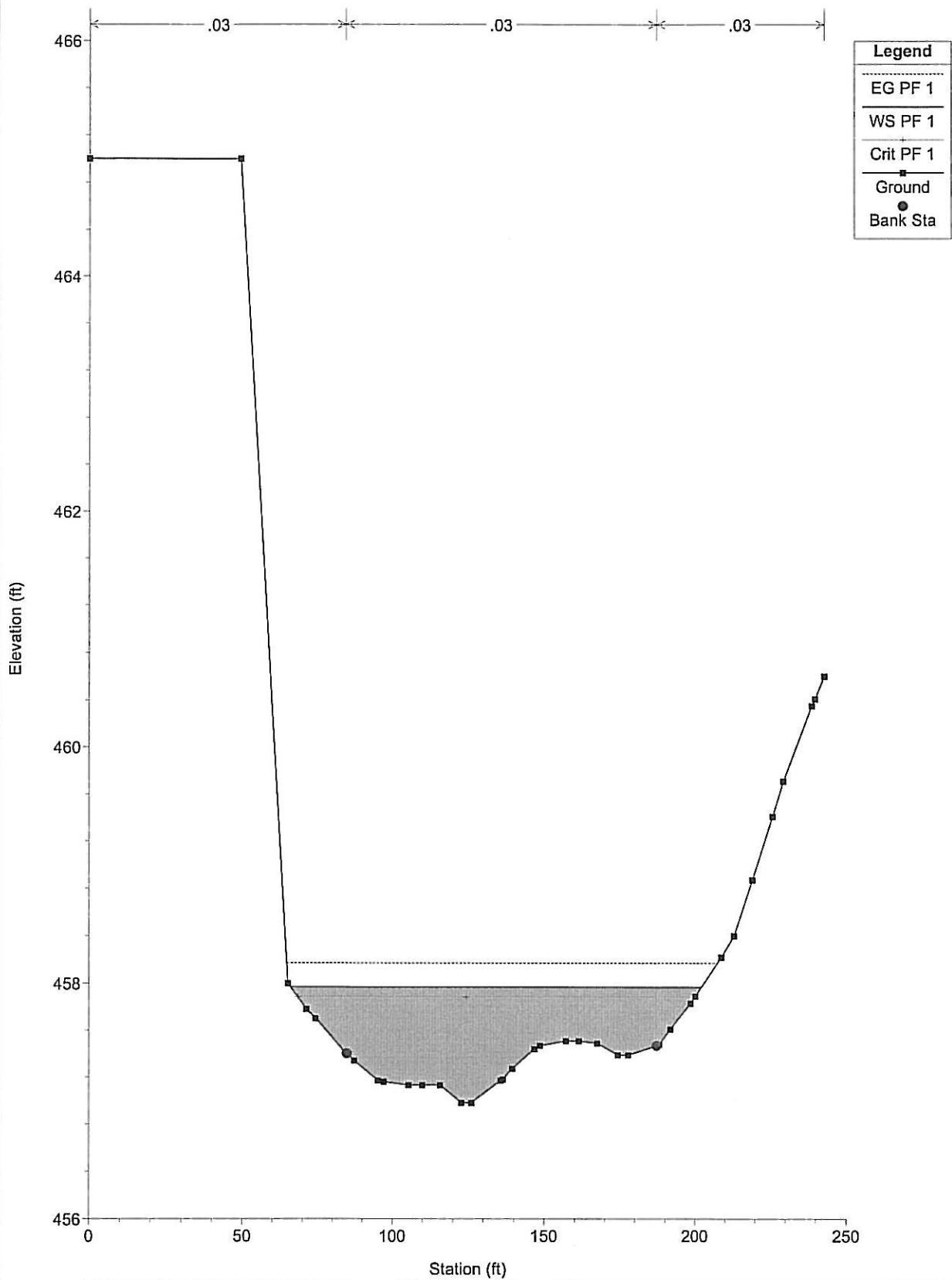
DEVELOPED 100-YR INUNDATION YORK DR Plan: DEVINUNDATION 3/21/2008

5



DEVELOPED 100-YRINUNDATION YORK DR

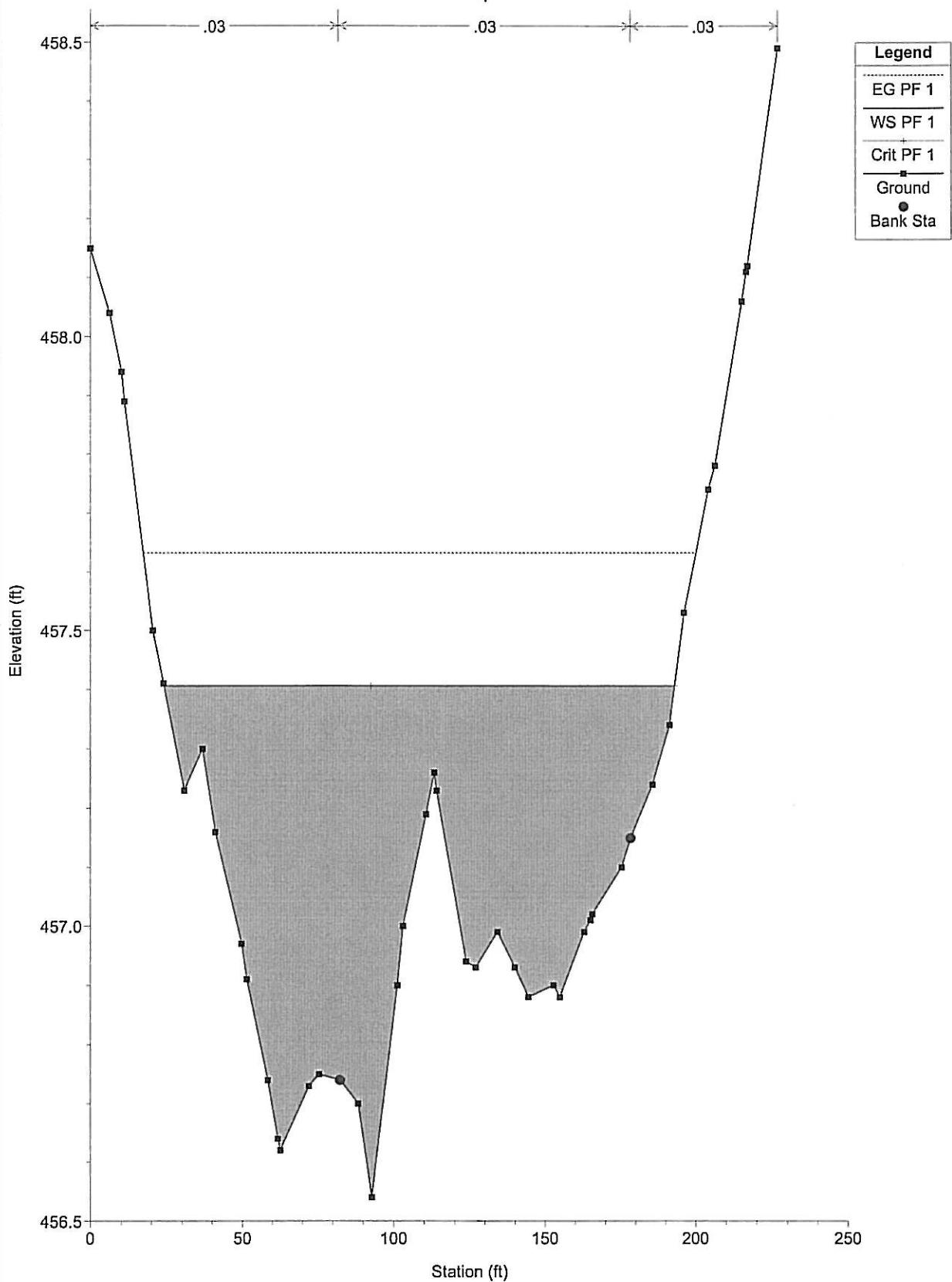
Plan: DEVINUNDATION 3/21/2008



DEVELOPED 100-YR INUNDATION YORK DR

Plan: DEVINUNDATION 3/21/2008

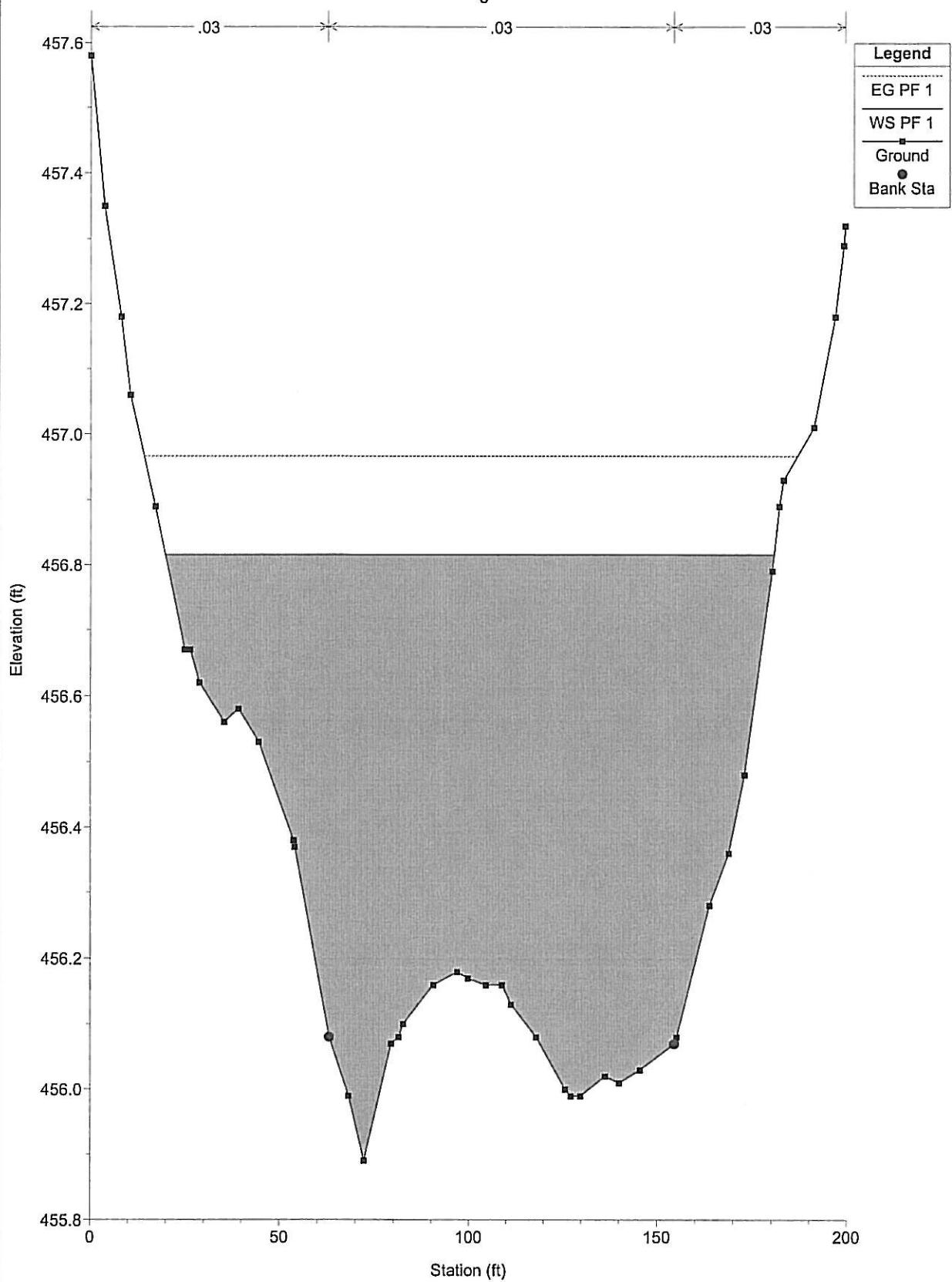
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Plan: DEVINUNDATION 3/21/2008

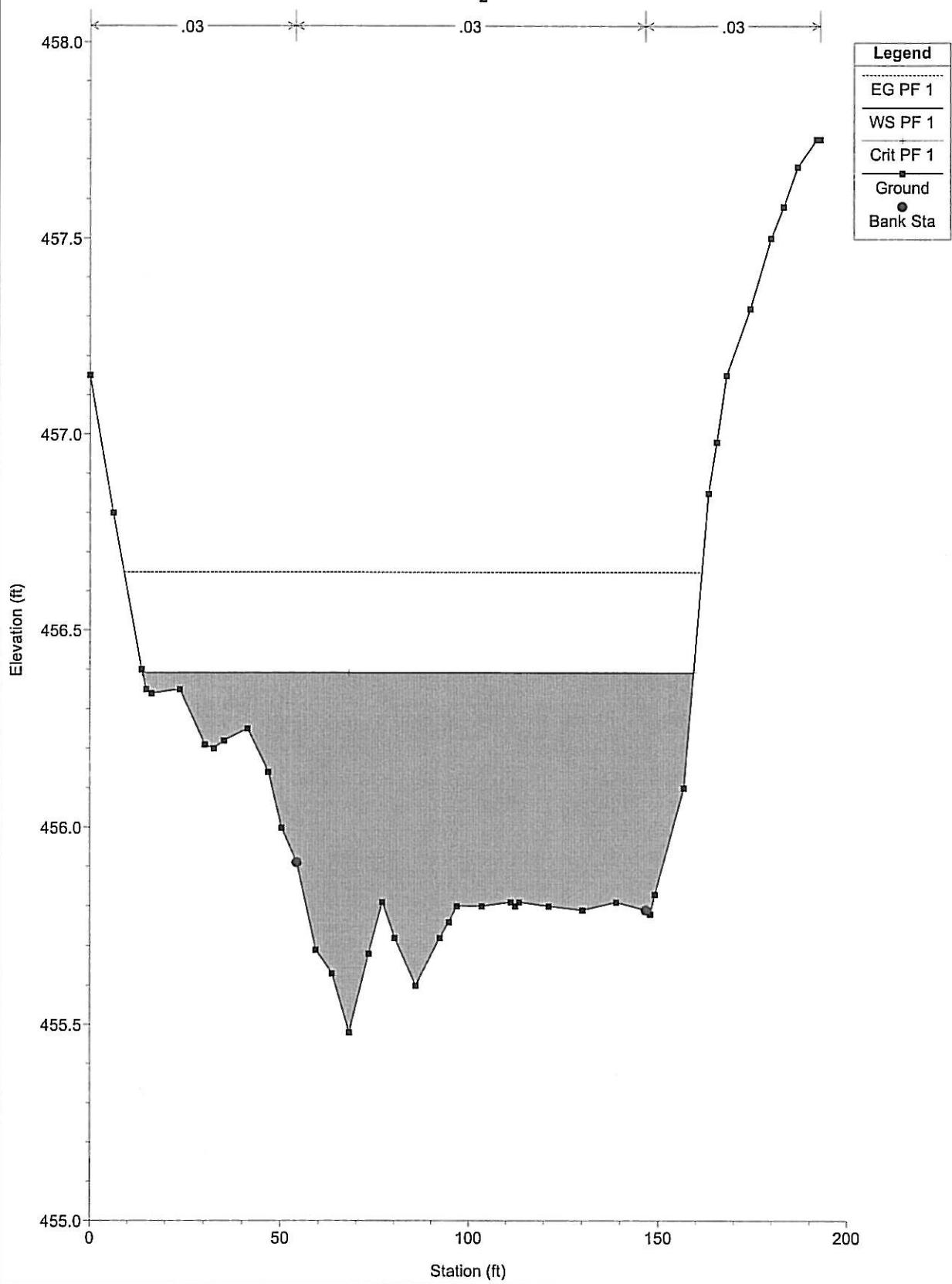
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DEVELOPED 100-YR INUNDATION YORK DR

Plan: DEVINUNDATION 3/21/2008

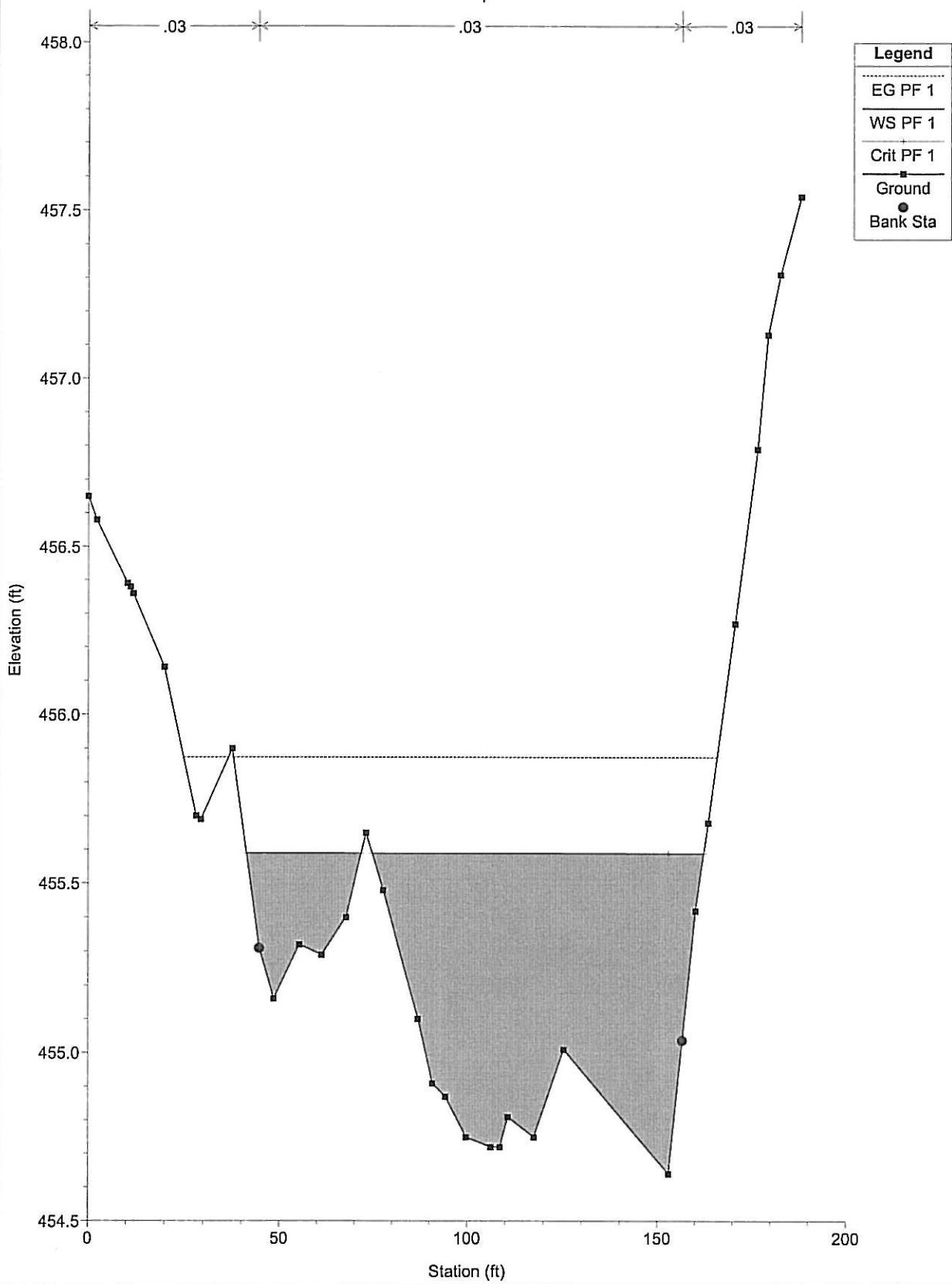
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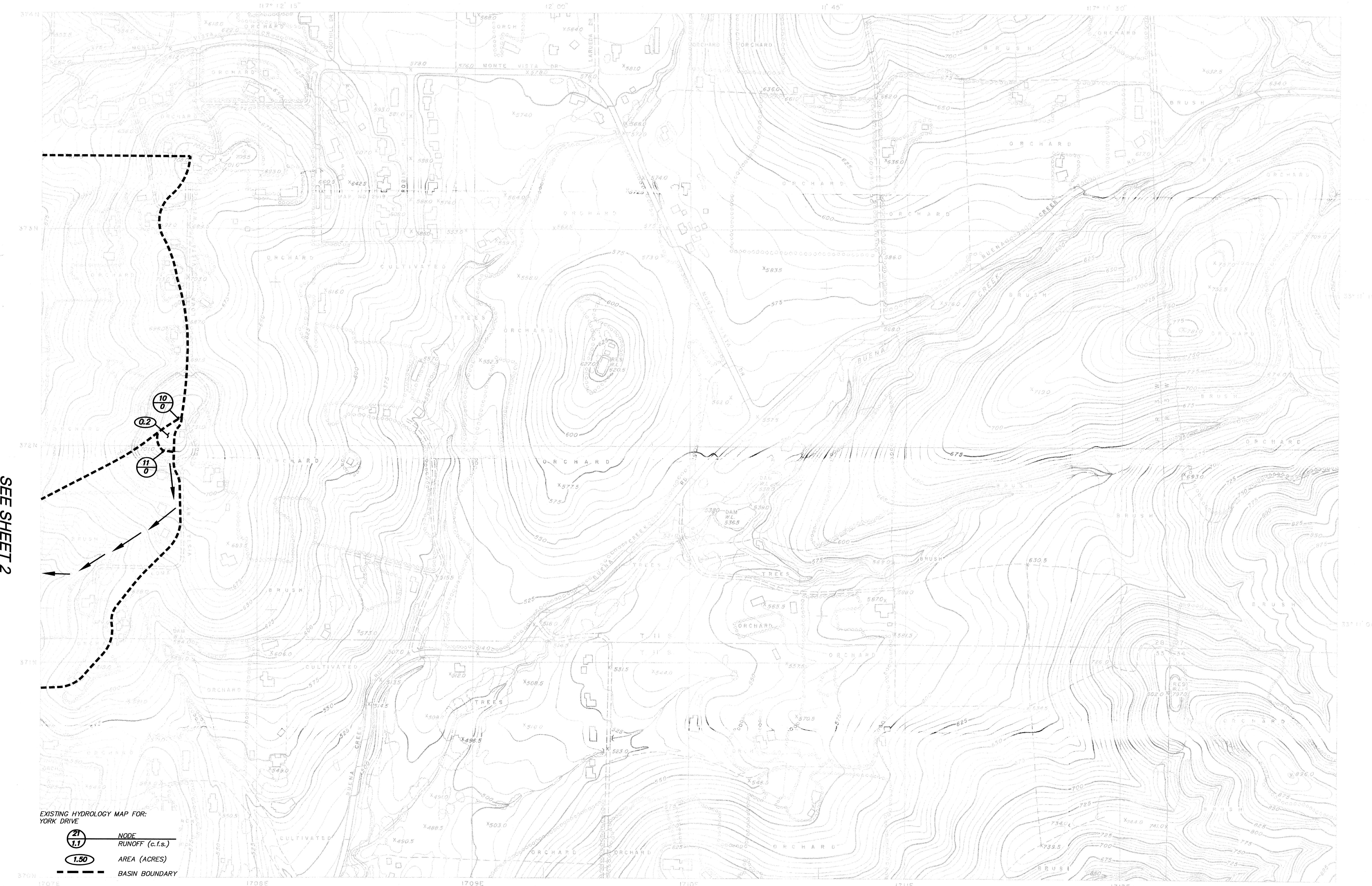
Plan: DEVINUNDATION 3/21/2008

1



### III. EXHIBITS

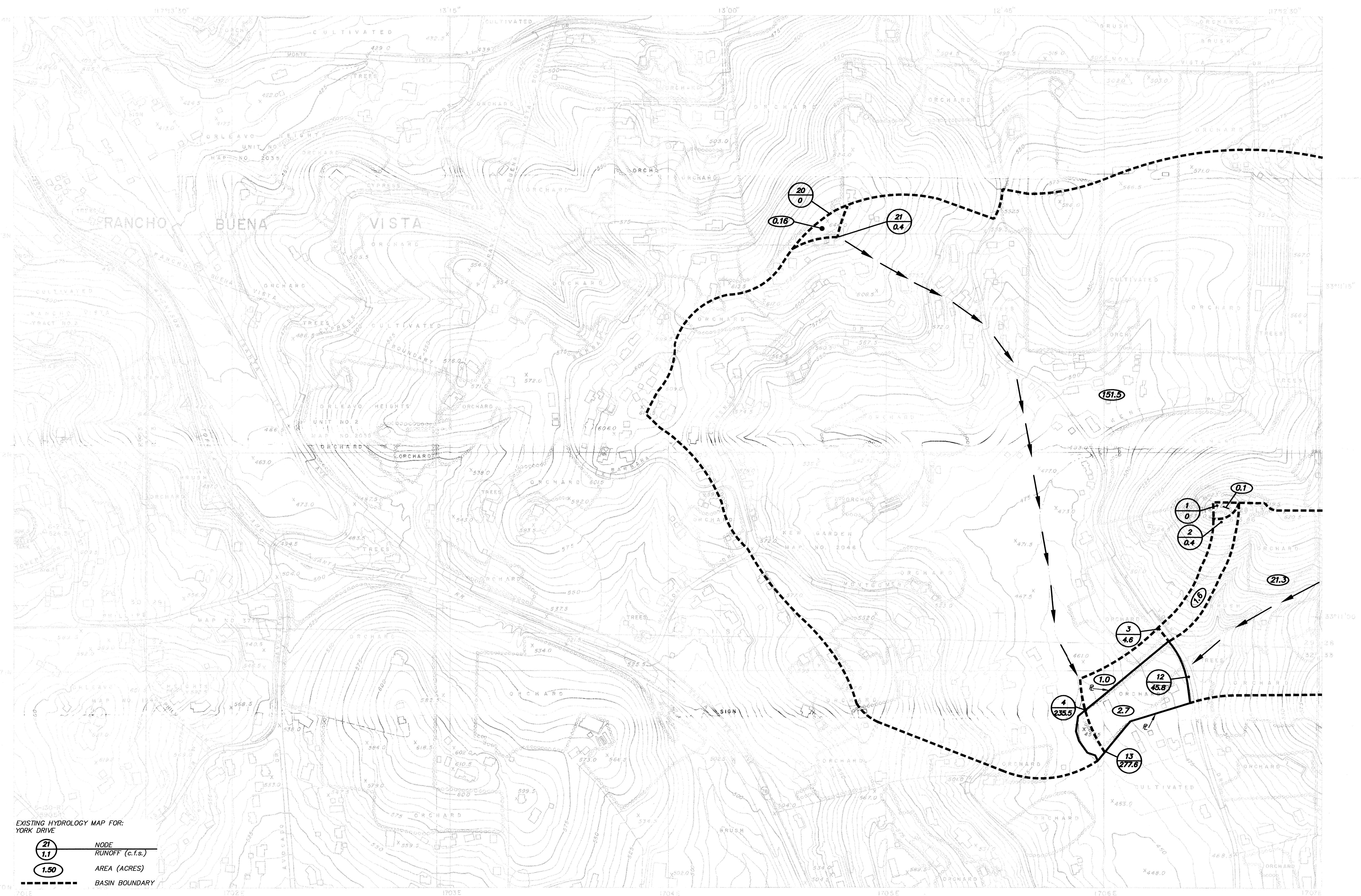
TOPOGRAPHIC SURVEY



SAN DIEGO COUNTY  
CALIFORNIA EXISTING HYDROLOGY MAP FOR:  
1505 YORK DRIVE  
W.C. 757-1019-400  
EDITION OF 1960  
SHEET 1 OF 2  
SHEET 21-30  
370-1707

## COUNTY OF SAN DIEGO

## TOPOGRAPHIC SURVEY



SEE SHEET 1

## INDEX TO ADJOINING SHEETS

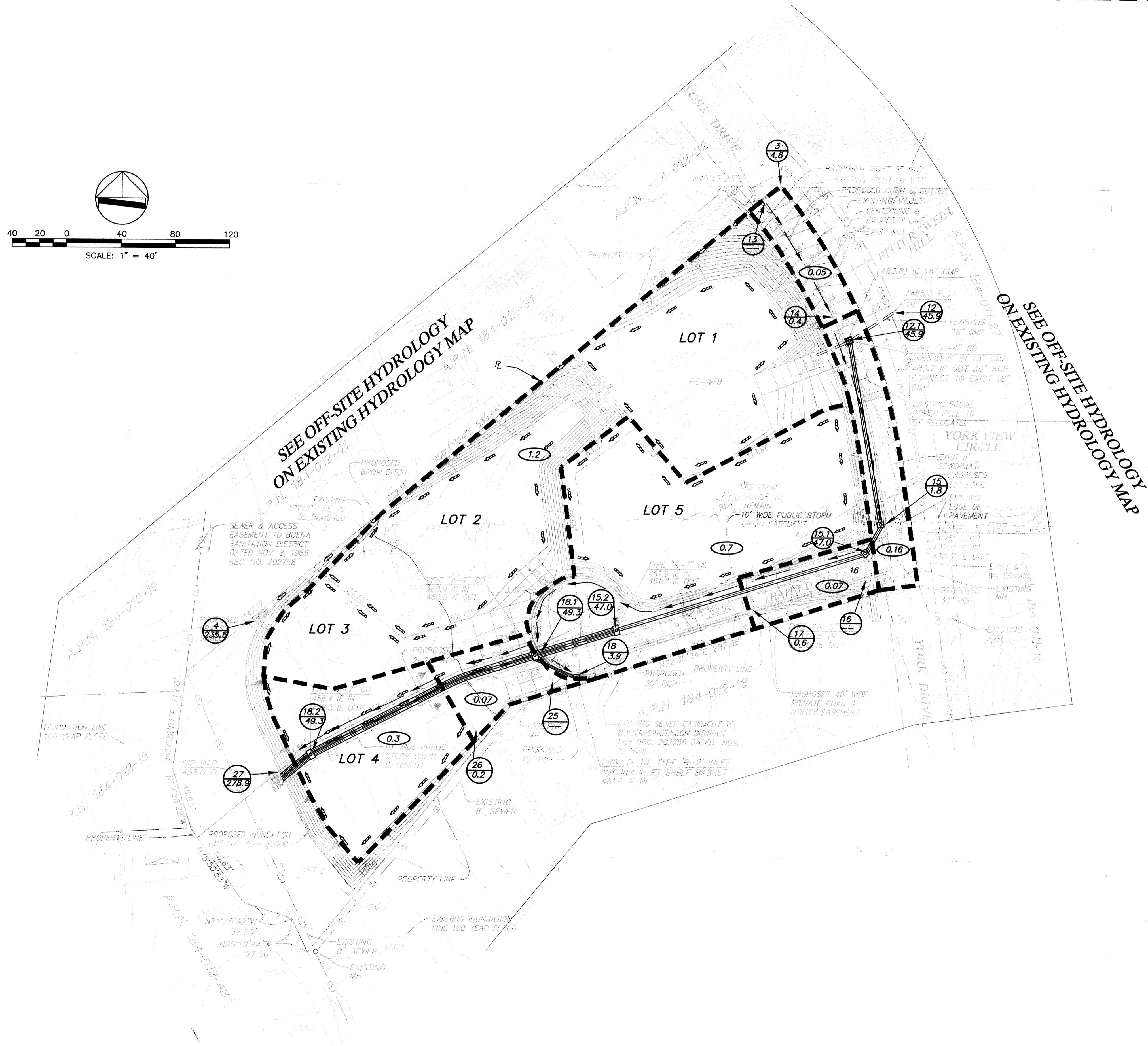
19-29	20-29	21-29
19-30	20-30	21-30

SCALE 1:2400  
CONTOUR INTERVAL 5 FEET  
U. S. C. & G. S. DATUM  
ONE THOUSAND FOOT CALIFORNIA RECTANGULAR GRID (ZONE VII)

374-1695	374-1701	374-1707
370-1695	370-1701	370-1707
366-1695	366-1701	366-1707

EXISTING HYDROLOGY MAP FOR:  
1505 YORK DRIVE  
W.O. 757-1019-400  
SAN DIEGO COUNTY  
CALIFORNIA  
SHEET 2 OF 2  
EDITION 1/160

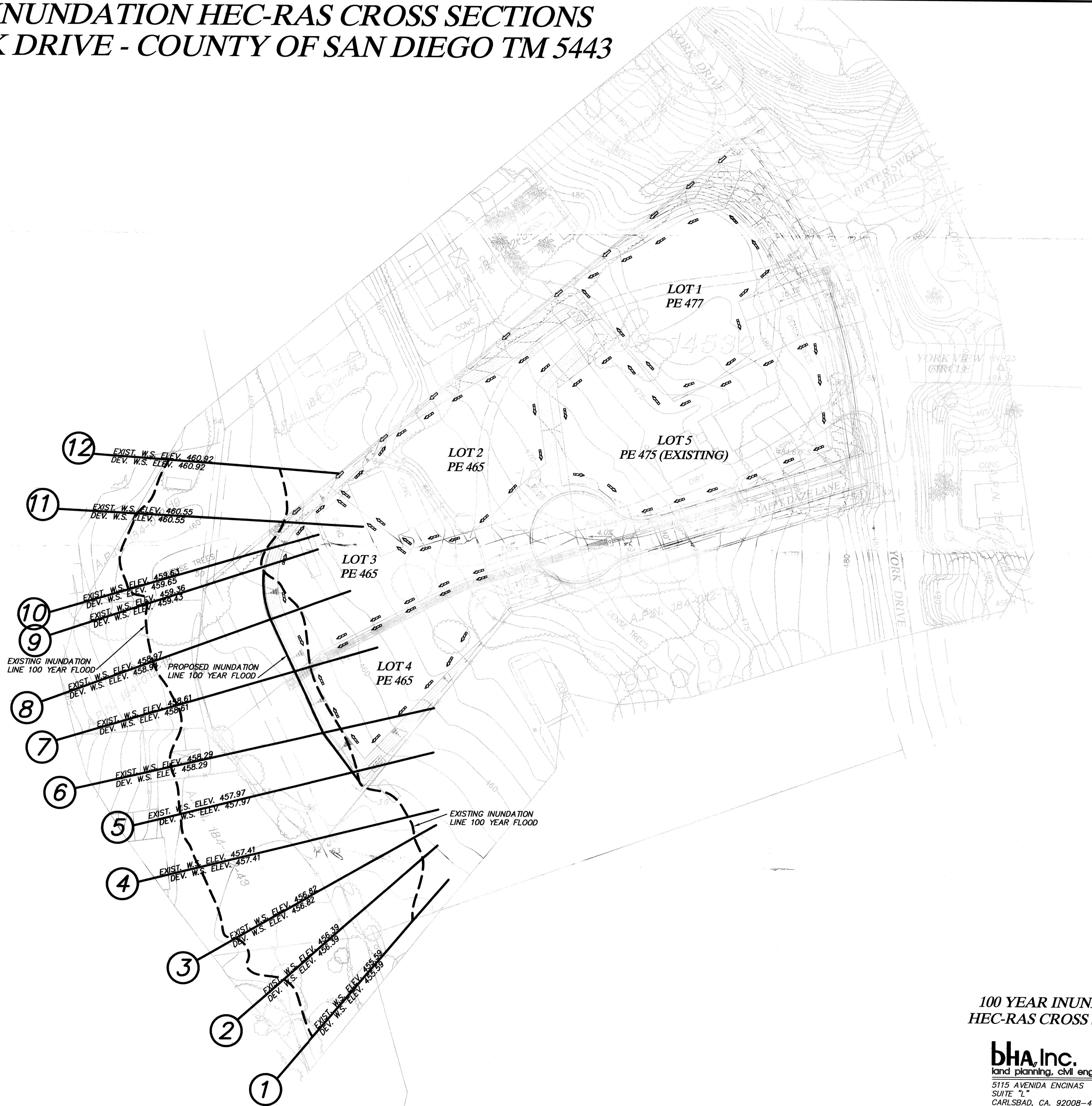
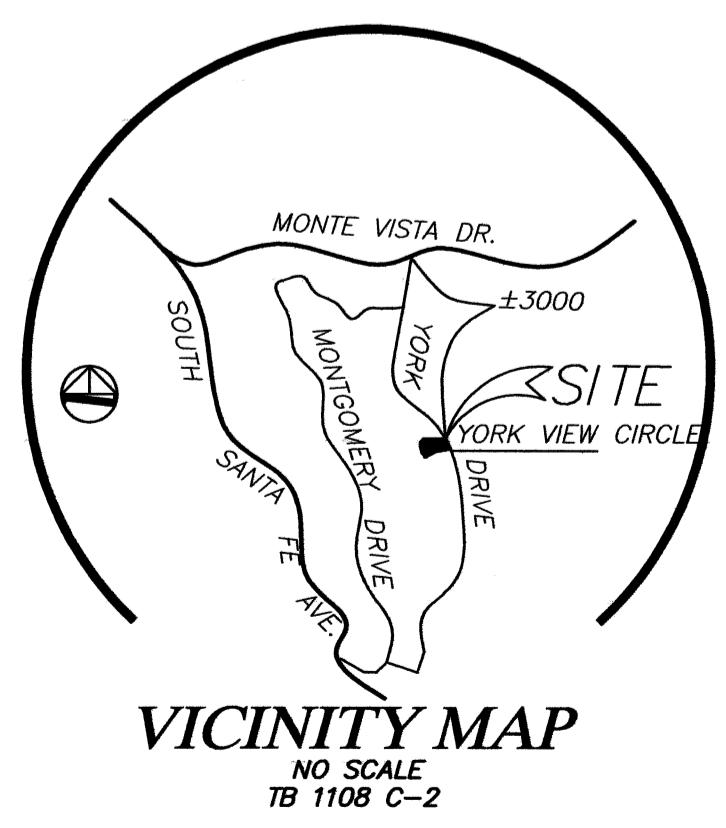
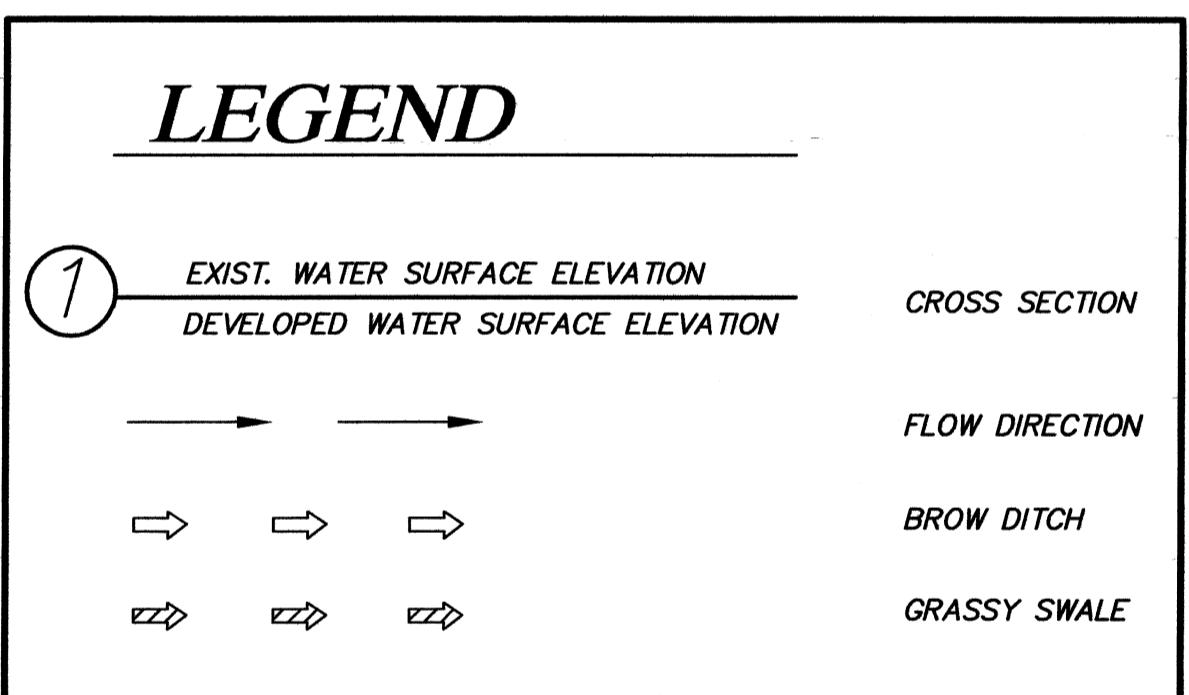
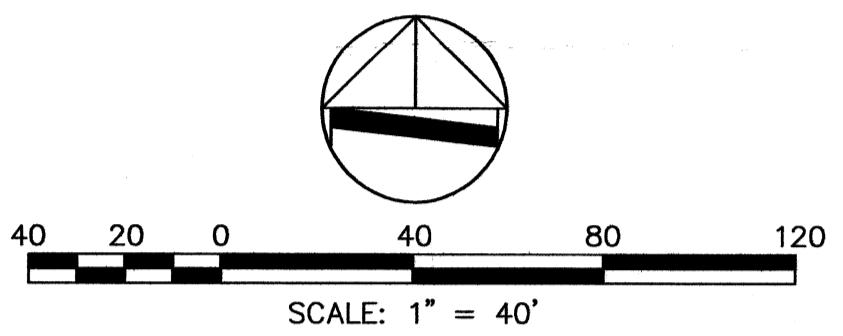
*DEVELOPED HYDROLOGY MAP  
1505 YORK DRIVE - COUNTY OF SAN DIEGO TRACT NO. 5443 RPL 2*



# *DEVELOPED HYDROLOGY MAP*



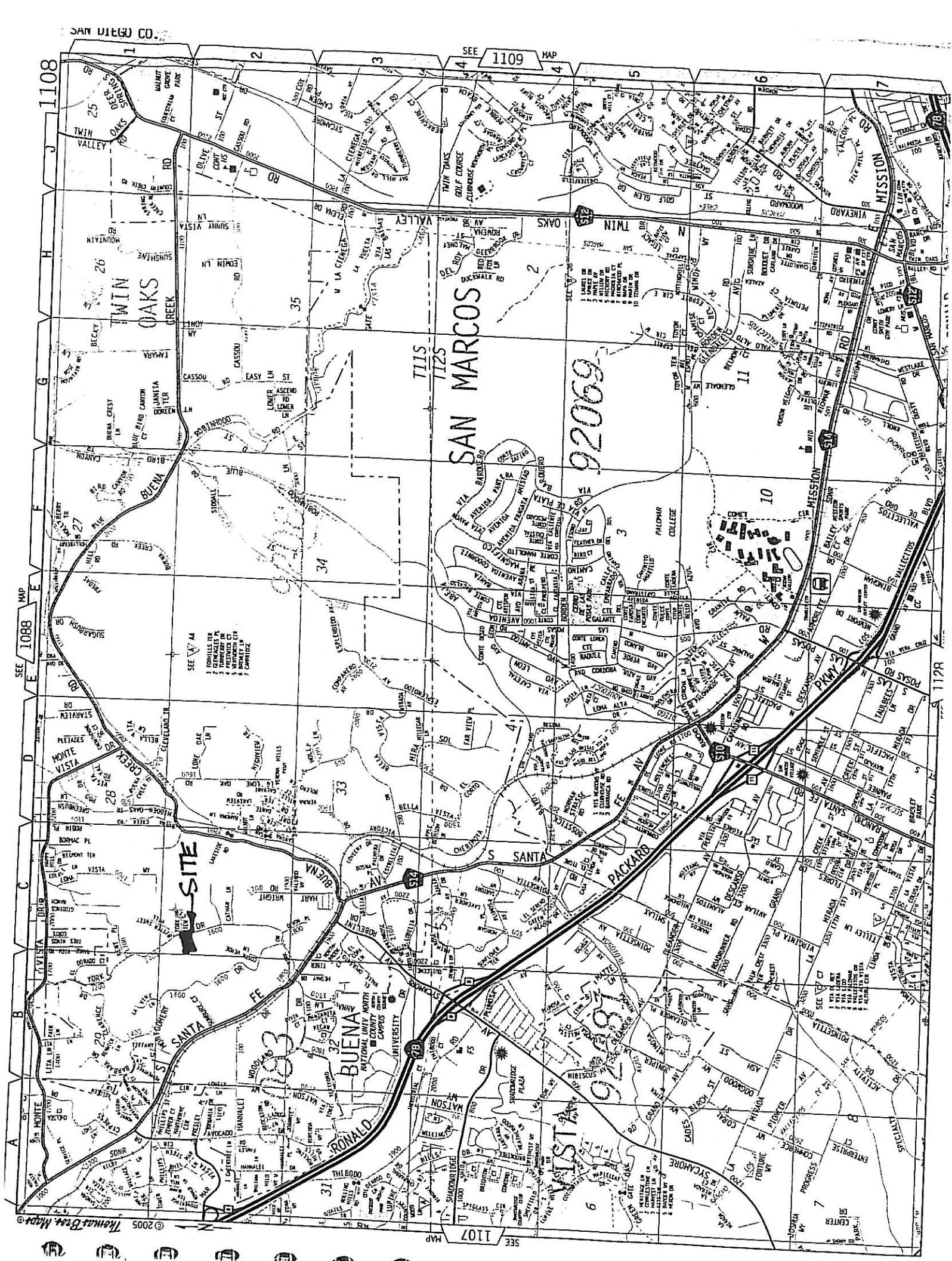
**100 YEAR INUNDATION HEC-RAS CROSS SECTIONS  
1505 YORK DRIVE - COUNTY OF SAN DIEGO TM 5443**



**100 YEAR INUNDATION  
HEC-RAS CROSS SECTIONS**

**bHA Inc.**  
land planning, civil engineering, surveying  
5115 AVENIDA ENCINAS  
SUITE "L"  
CARLSBAD, CA. 92008-4387  
(760) 931-8700

#### **IV. REFERENCES**



## Intensity-Duration Design Chart • Template

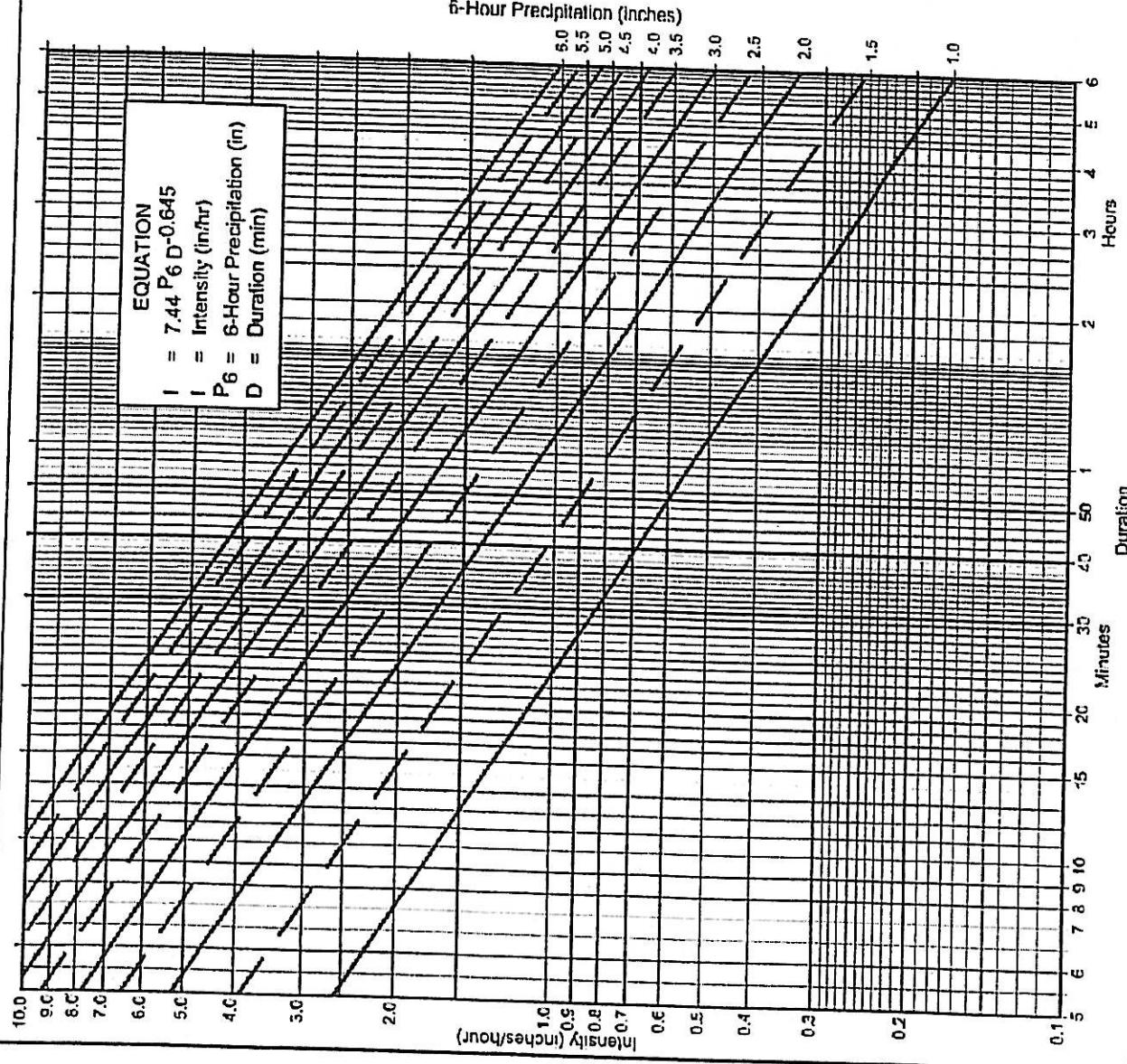
**Directions for Application:**

- (1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).
- (2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicable to Desert).
- (3) Plot 6 hr precipitation on the right side of the chart.
- (4) Draw a line through the point parallel to the plotted lines.
- (5) This line is the intensity-duration curve for the location being analyzed.

**Application Form:**

- (a) Selected frequency 100 year  
 (b)  $P_6 = \underline{3.5}$  in.,  $P_{24} = \underline{5.8}$ ,  $\frac{P_6}{P_{24}} = \underline{60\%}$   
 (c) Adjusted  $P_6^{(24)} = \underline{2.5}$  in.  
 (d)  $I_x = \underline{\quad}$  min.  
 (e)  $I = \underline{\quad}$  in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.



# County of San Diego Hydrology Manual



## Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

..... Isopluvial (Inches)

**SanGIS**

San Diego Public Works

Geographic Information System

City of San Diego

County of San Diego

City of Chula Vista

City of Imperial Beach

City of National City

City of Oceanside

City of San Marcos

City of San Ysidro

City of Spring Valley

City of Vista

City of

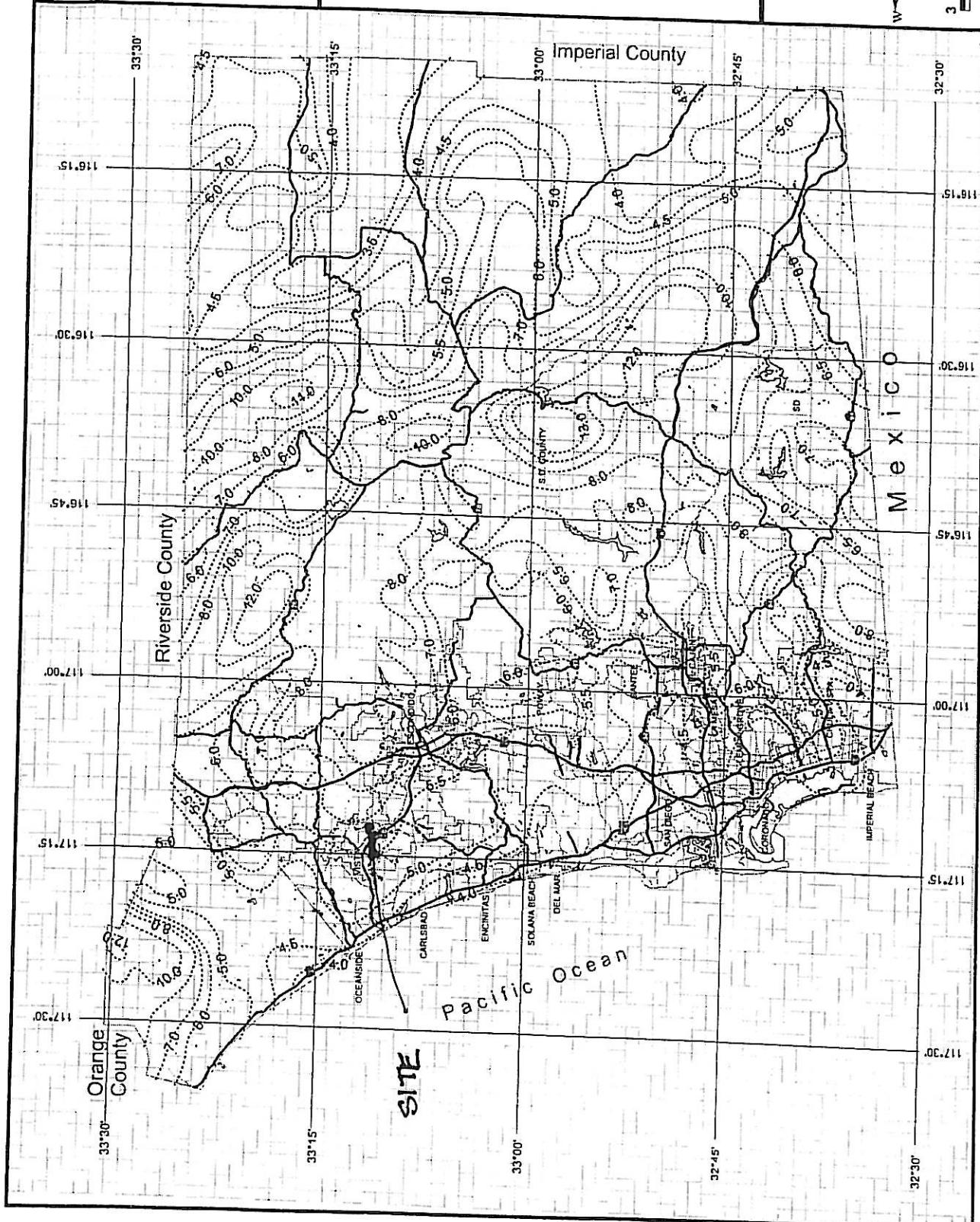
County of San Diego  
Hydrology Manual



Rainfall Isoplevials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)



# County of San Diego Hydrology Manual



## Soil Hydrologic Groups

### Legend

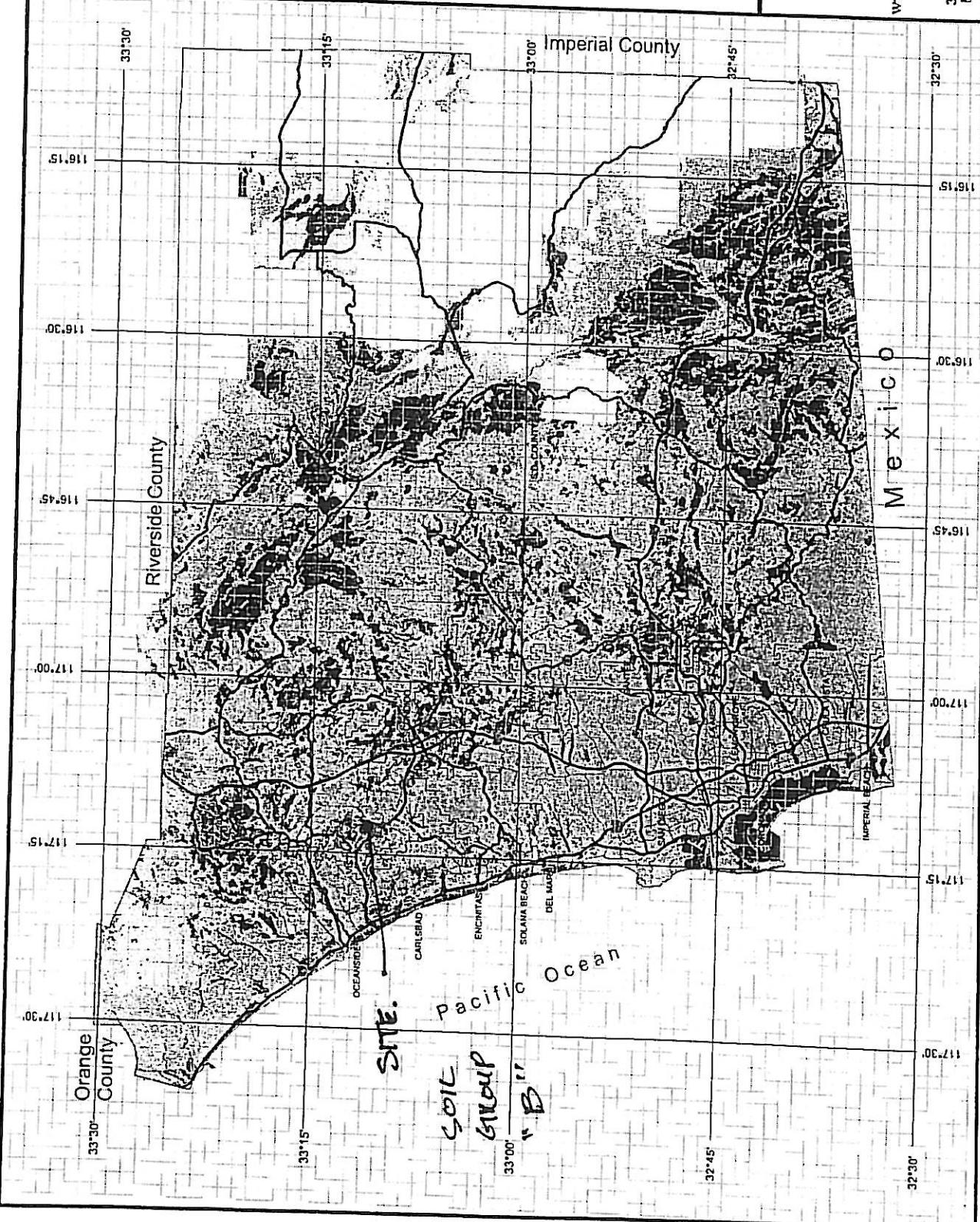
Soil Groups	Group A	Group B	Group C	Group D	Undetermined	Data Unavailable

SanGIS  
City of San Diego Council

DPW GIS  
Department of Public Works

Nic Hix San Diego Council  
The City of San Diego Council

3 Miles



**Table 3-1**  
**RUNOFF COEFFICIENTS FOR URBAN AREAS**

NRCS Elements	Land Use	County Elements	Runoff Coefficient "C"			
			% IMPER.	A	B	C
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
*Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

\*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).

DU/A = dwelling units per acre  
NRCS = National Resources Conservation Service

Note that the Initial Time of Concentration should be reflective of the general land-use at the upstream end of a drainage basin. A single lot with an area of two or less acres does not have a significant effect where the drainage basin area is 20 to 600 acres.

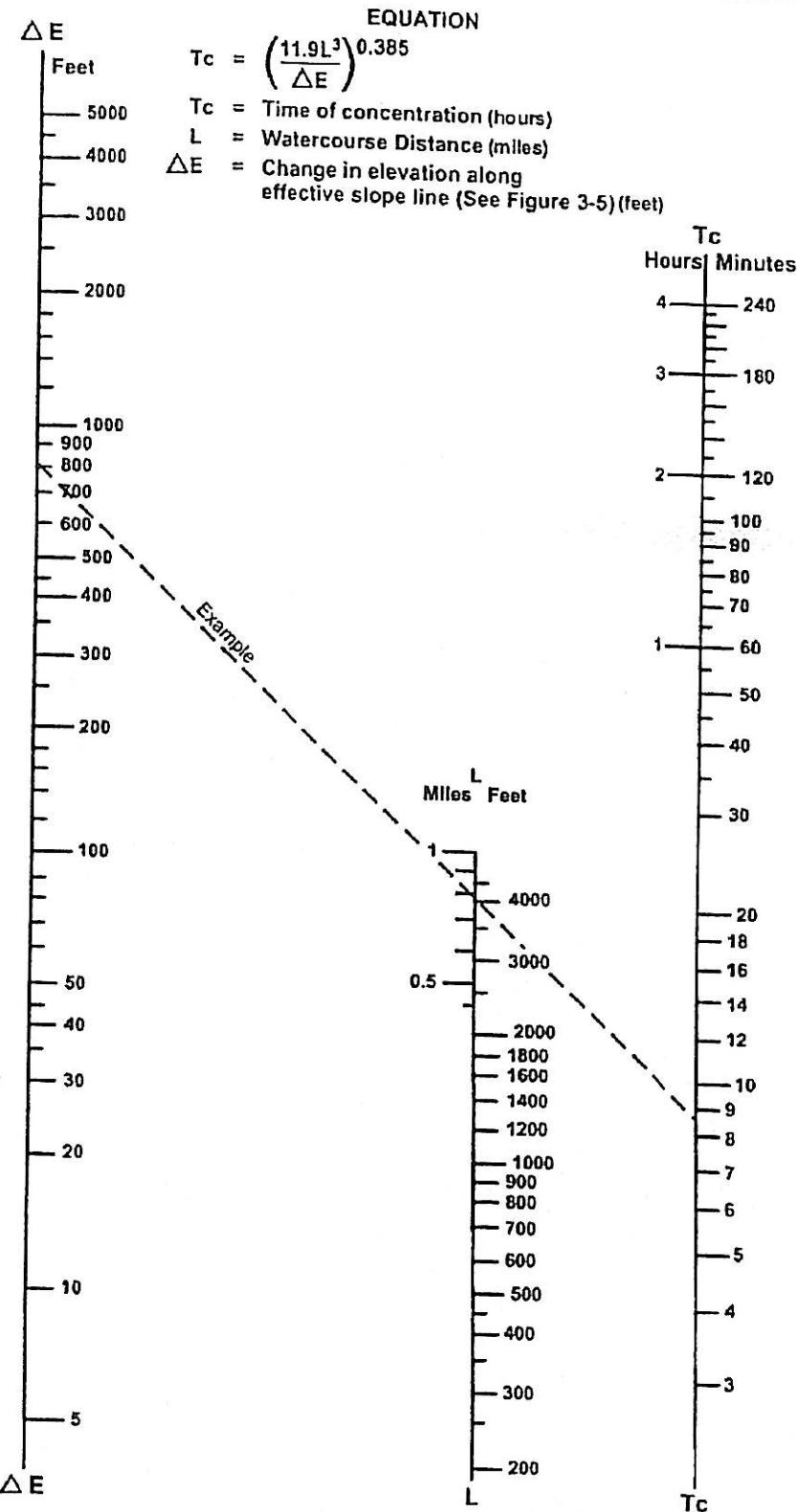
Table 3-2 provides limits of the length (Maximum Length ( $L_M$ )) of sheet flow to be used in hydrology studies. Initial  $T_i$  values based on average C values for the Land Use Element are also included. These values can be used in planning and design applications as described below. Exceptions may be approved by the "Regulating Agency" when submitted with a detailed study.

**Table 3-2**

**MAXIMUM OVERLAND FLOW LENGTH ( $L_M$ )  
& INITIAL TIME OF CONCENTRATION ( $T_i$ )**

Element*	DU/ Acre	.5%		1%		2%		3%		5%		10%	
		$L_M$	$T_i$										
Natural		50	13.2	70	12.5	85	10.9	100	10.3	100	8.7	100	6.9
LDR	1	50	12.2	70	11.5	85	10.0	100	9.5	100	8.0	100	6.4
LDR	2	50	11.3	70	10.5	85	9.2	100	8.8	100	7.4	100	5.8
LDR	2.9	50	10.7	70	10.0	85	8.8	95	8.1	100	7.0	100	5.6
MDR	4.3	50	10.2	70	9.6	80	8.1	95	7.8	100	6.7	100	5.3
MDR	7.3	50	9.2	65	8.4	80	7.4	95	7.0	100	6.0	100	4.8
MDR	10.9	50	8.7	65	7.9	80	6.9	90	6.4	100	5.7	100	4.5
MDR	14.5	50	8.2	65	7.4	80	6.5	90	6.0	100	5.4	100	4.3
HDR	24	50	6.7	65	6.1	75	5.1	90	4.9	95	4.3	100	3.5
HDR	43	50	5.3	65	4.7	75	4.0	85	3.8	95	3.4	100	2.7
N. Com		50	5.3	60	4.5	75	4.0	85	3.8	95	3.4	100	2.7
G. Com		50	4.7	60	4.1	75	3.6	85	3.4	90	2.9	100	2.4
O.P./Com		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
Limited I.		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
General I.		50	3.7	60	3.2	70	2.7	80	2.6	90	2.3	100	1.9

\*See Table 3-1 for more detailed description

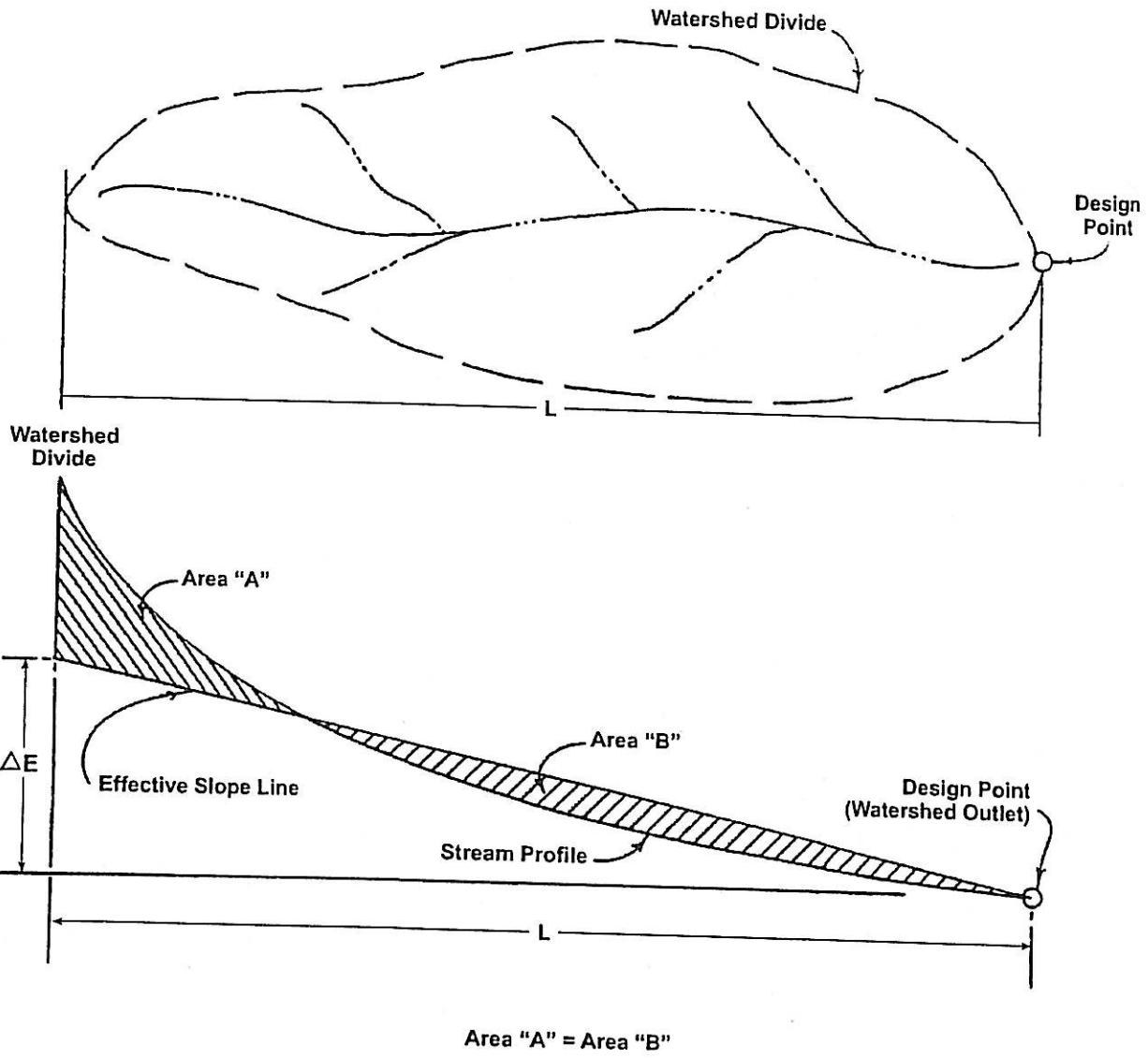


SOURCE: California Division of Highways (1941) and Kirpich (1940)

Nomograph for Determination of  
Time of Concentration ( $T_c$ ) or Travel Time ( $T_t$ ) for Natural Watersheds

FIGURE

**3-4**

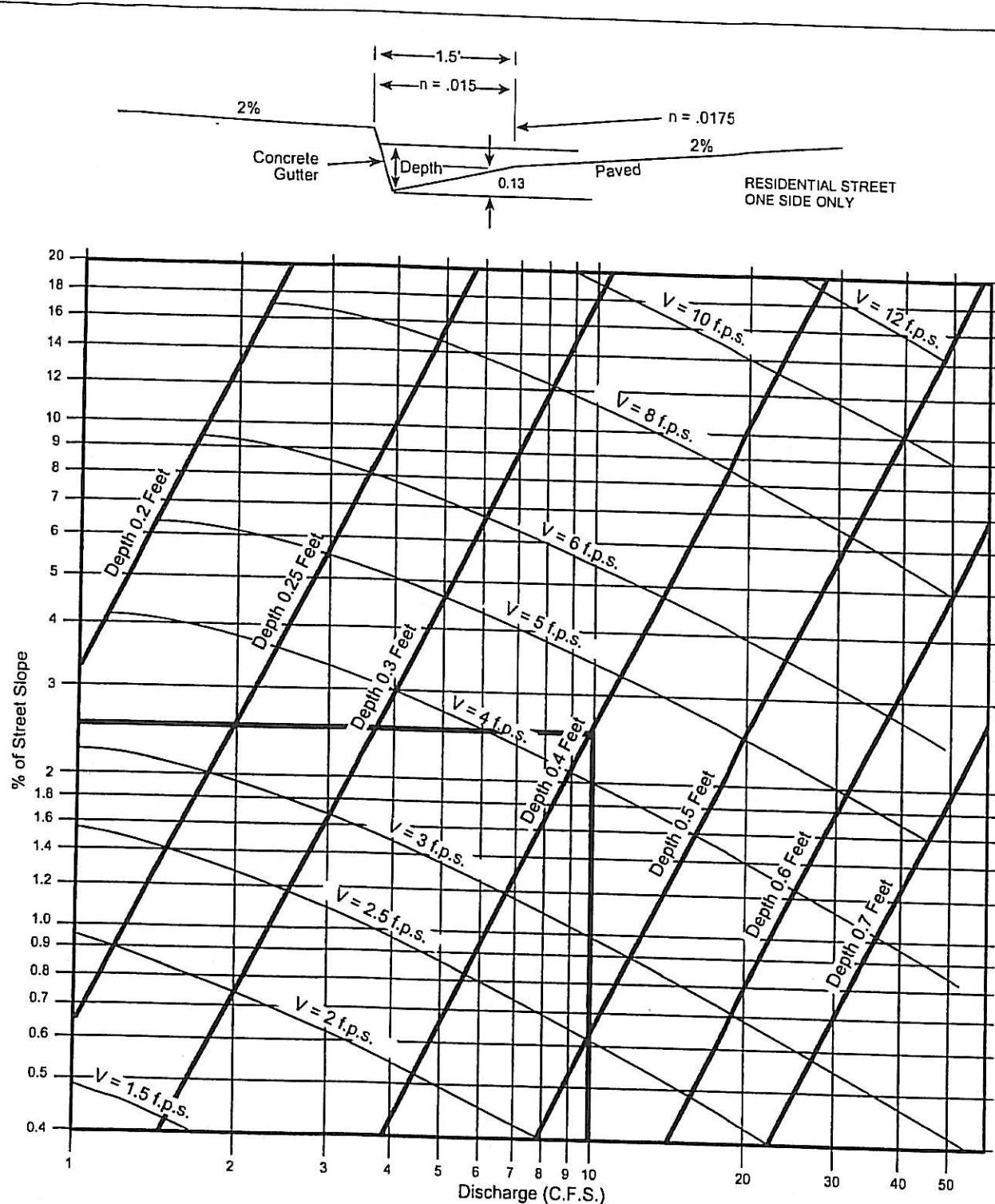


SOURCE: California Division of Highways (1941) and Kirpich (1940)

FIGURE

Computation of Effective Slope for Natural Watersheds

3-5



**EXAMPLE:**

Given:  $Q = 10$     $S = 2.5\%$

Chart gives: Depth = 0.4, Velocity = 4.4 f.p.s.

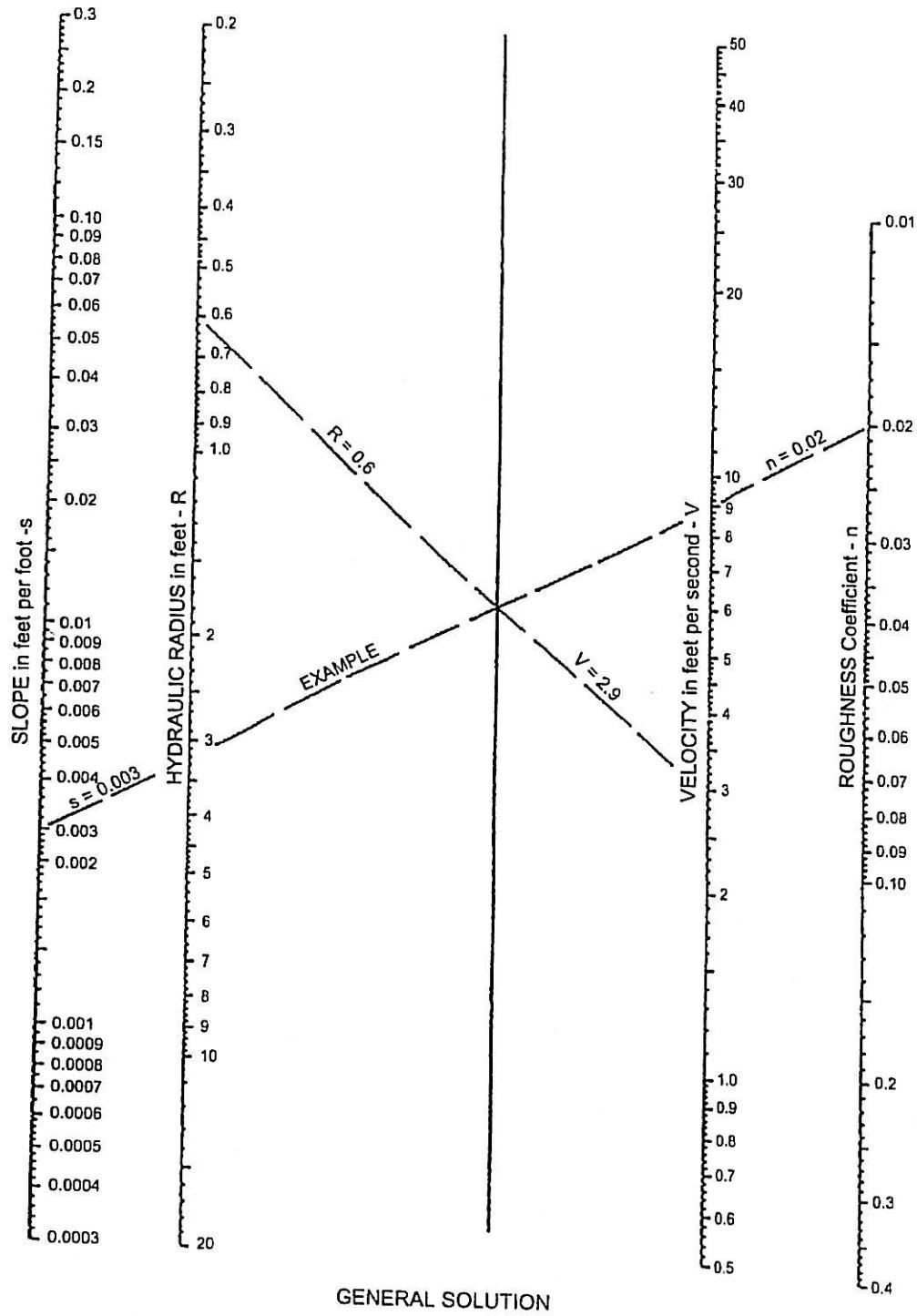
SOURCE: San Diego County Department of Special District Services Design Manual

F I G U R E

Gutter and Roadway Discharge - Velocity Chart

**3-6**

$$\text{EQUATION: } V = \frac{1.49}{n} R^{2/3} S^{1/2}$$



SOURCE: USDOT, FHWA, HDS-3 (1961)

FIGURE

Manning's Equation Nomograph

3-7